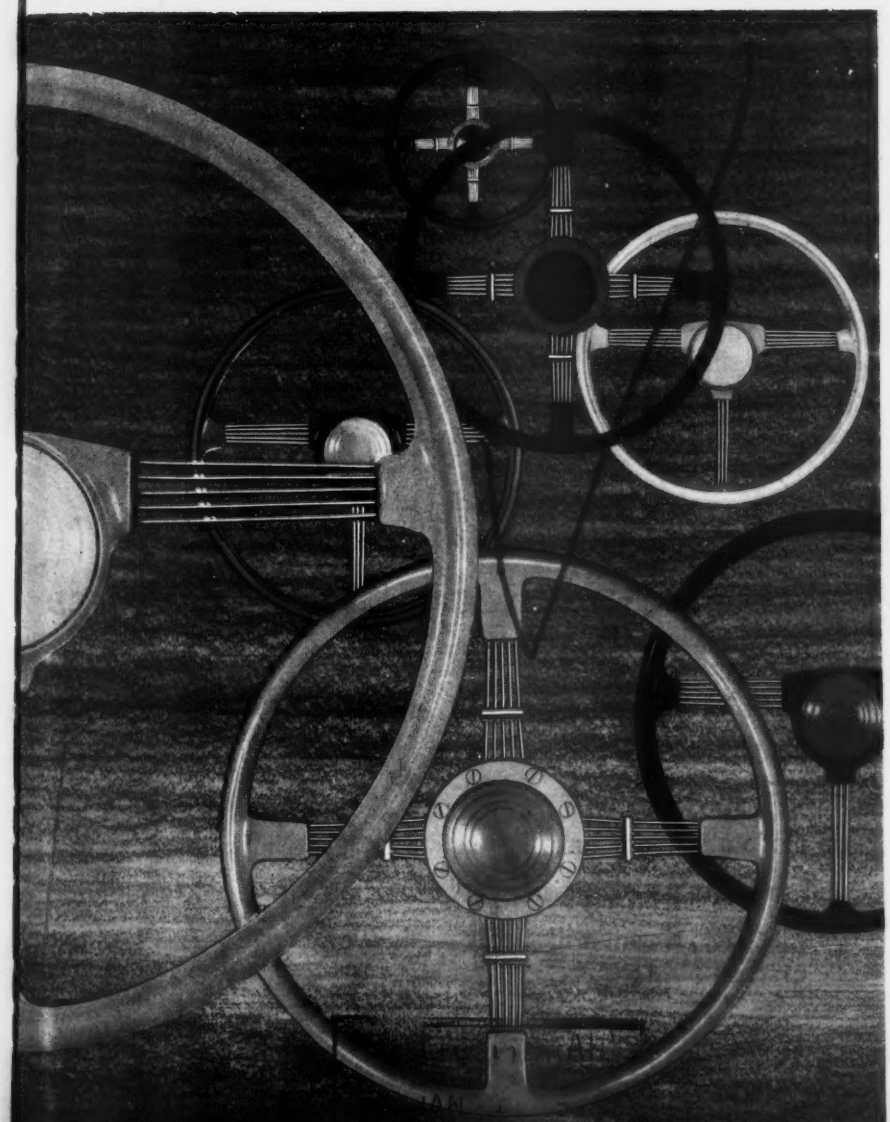
Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS



the parts of the car that you handle

Not only the steering wheel: many components and accessories that stare the driver and passenger in the face are made with plastics. They're important: a car may be judged on their merits. That's why famous manufacturers choose Courtaulds' cellulose acetate — lastingly tough, won't shatter or crack, kind to touch and sight.

Courtaulds LTD

cellulose acetate moulding Powder

not brittle
extremely tough and durable
unlimited colours
no fire risks · clean contours

Plastics Division:
Little Heath, Coventry. Tel: Coventry 88031.
16 St. Martin's-le-Grand, London, E.C.1.
Tel: MONarch 8811.

Courtaulds' Technical Service
welcomes your enquiries about any aspect of plastics.

D

The handles of all these brushes are moulded from Bexoid Moulding Powder. Illustration by kind permission of the following brush manufacturers: Halex Ltd., Betterwear Products Ltd., Denman Products Ltd., C. F. Marshall & Son Ltd., Aktiebolaget Husqvarna Borstfabrik, Huskvarna.

Bristling with advantages

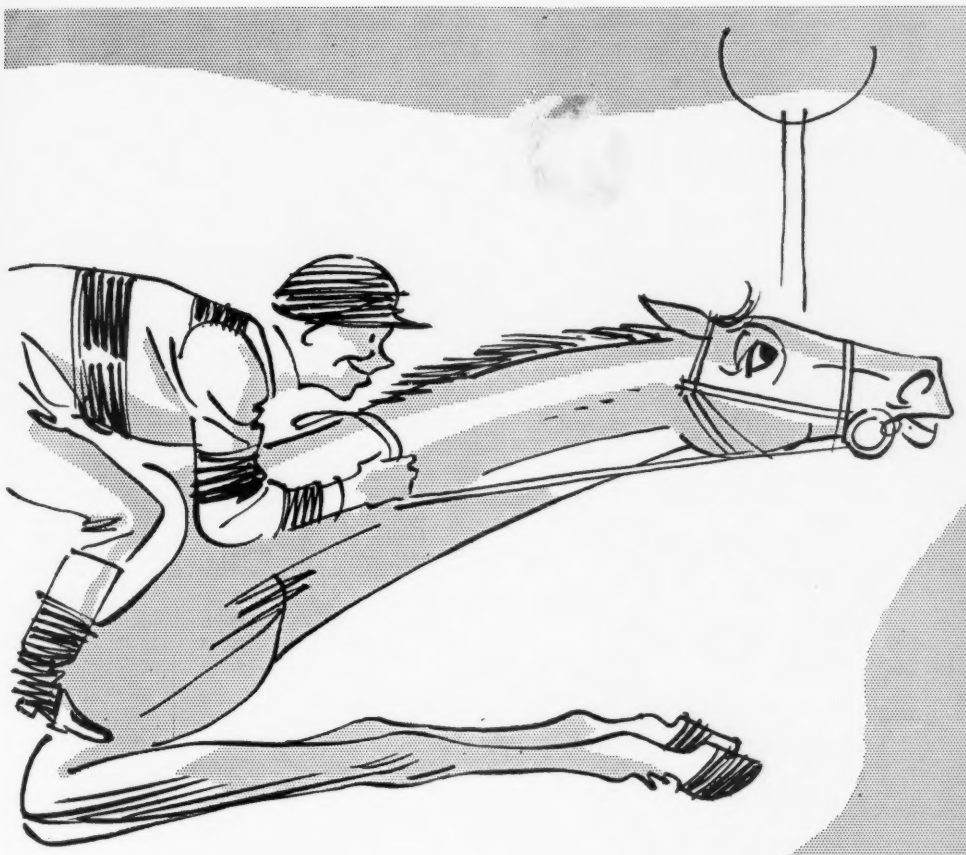
Bexoid-moulded Brush Handles

For all their beauty, Bexoid-moulded brush handles are tough! They give firm anchorage to bristles, stand up perfectly to the bristling process. Bexoid Moulding Powder colour range includes opaque, transparent, translucent and pearl effects. Mouldings can be made at temperatures normal to standard injection machines and present a high finish without buffing. The BX Moulding Powder Department will gladly advise you on the use of Bexoid Moulding Powder. Ask to see the latest colour swatch.

BEXOID MOULDING POWDERS

BX PLASTICS LTD., Higham Station Avenue, Chingford, London, E.4. *Telephone: LARkswood 5511*

R v.20' Ja-De'55



It's the finish that counts

Of course it all depends on what you mean (to quote a Joadism) by finish. But there is no doubt that when it comes to any kind of barrel finishing, Lacrinoid materials win by several lengths.

Readers are invited to send to Lacrinoid Products Ltd., samples of the "work" with which they are concerned. Lacrinoid will investigate the problem by practical tests and will submit a report (without charge) including estimates of the process costs.

LACRINOID BARREL POLISHING **MATERIALS**

"Finer Finishing Faster"

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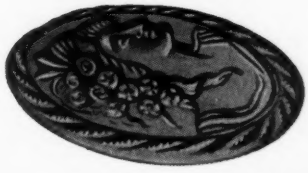
Cerrobend melting at 158°F, Cerrobase at 255°F and Cerrotru at 281°F are easily sprayed against master models with inexpensive equipment. The resultant negative cavity, reproducing the finest detail, provides excellent mould for short runs in thermoplastics. After use moulds may be re-melted and metal fully recovered.



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THE BRITISH OXYGEN COMPANY LTD

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"Everflex" material produced by Bernard Wardle (Everflex) Ltd.

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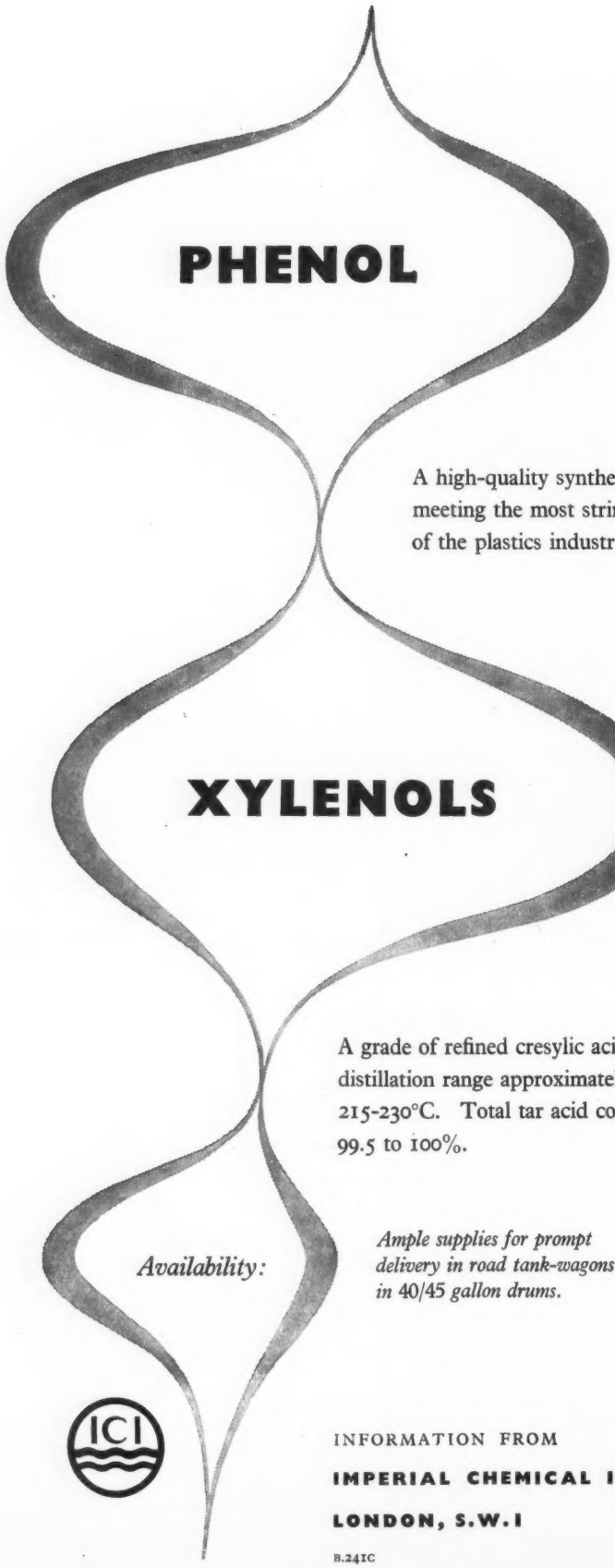

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This will be followed at intervals with

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E.D.A. are publishing a series of books on "Electricity and Productivity". Four titles are available at the moment; they deal with Higher Production, Lighting, Materials Handling, and Resistance Heating. The books are 8/6 each (9/- post free) and the Electricity Boards (or E.D.A. themselves) can supply you.

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Individual drive means power exactly where it is wanted. The motor is built into the tool and direct coupled to the driven shaft. Efficiency is higher, floor space is saved, belts are done away with. The machine is a self-contained unit and the drive is direct. There are no gears, no belts—so maintenance is low.

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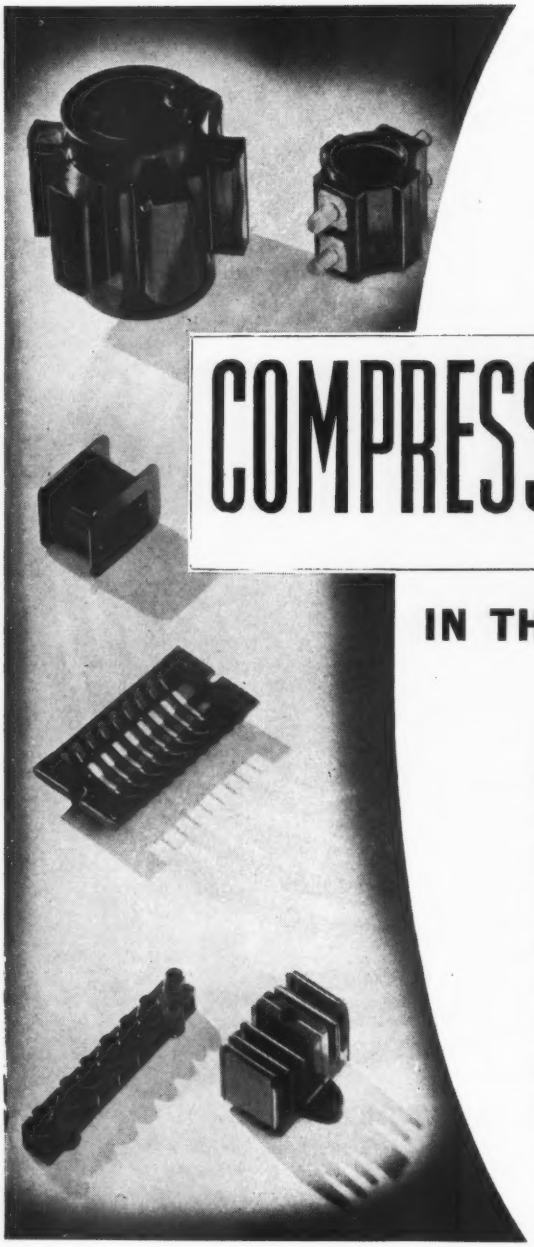

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You, too, can entrust your work to Thermo-Plastics Ltd. where production is planned to keep abreast of customers' requirements.

A highly qualified technical staff is at your service.

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Moulders and fabricators of all plastic materials, including glass and asbestos reinforced laminates, Perspex, P.V.C., Polystyrene, Cellulose Acetate, Polyethylene, Nylon, Phenol - Formaldehyde, Urea - Formaldehyde, etc.

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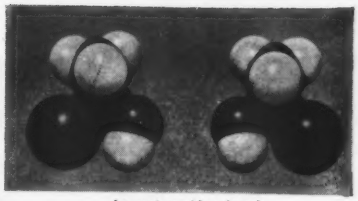
Telephone: DUNSTABLE 686/7/8 and 777 *Telegrams:* THERMOPLASTICS, DUNSTABLE

Catalin Molecular Models

for instruction in and the study of molecular configuration



Isomeric α-chlorethanols.
(Crown copyright reserved.)

Accurately dimensioned after the Stuart pattern, Catalin models give the truest possible representation of the stereochemical picture and provide the most convenient means of demonstrating the phenomena.

The models consist basically of distinctively coloured spheres and comprise:

ELEVEN ELEMENTS in their various valency states:
HYDROGEN · CARBON · NITROGEN
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- Complete with accessories in partitioned and lined leathercloth case.
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- Models for double or treble bonds are fitted with locking pins.

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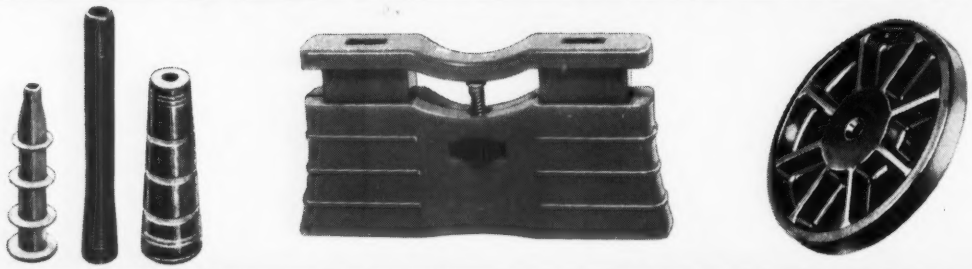
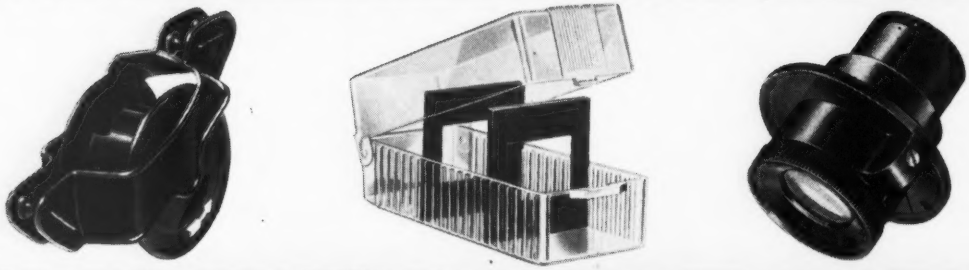
. . . whatever your requirements in plastic mouldings —



by injection or compression —— however large the



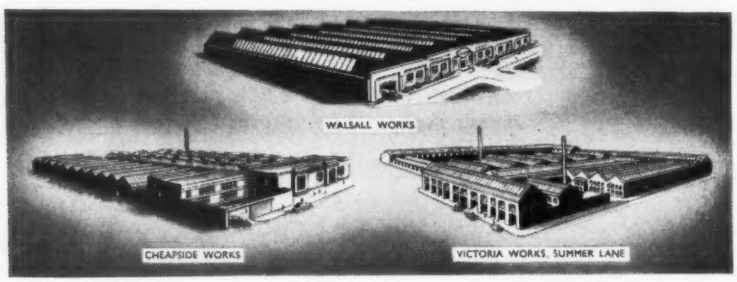
quantity —— we offer the finest service . . . .

WE have been in the plastic moulding business since its earliest days.

Our customers include many organisations which were comparatively unknown in our formative years—many did not even exist—yet whose products have now become household names. Just as much as our efforts have helped them to establish their reputation, so has their custom enabled us to grow until today, with four factories at our disposal, we have become one of the largest and best equipped independent plastic moulders to the trade.

The rebuilding of our main premises, partly destroyed in 1941, now enables us to offer even greater capacity and to extend our service next year to include 24 oz. mouldings. Your enquiries would be welcomed.

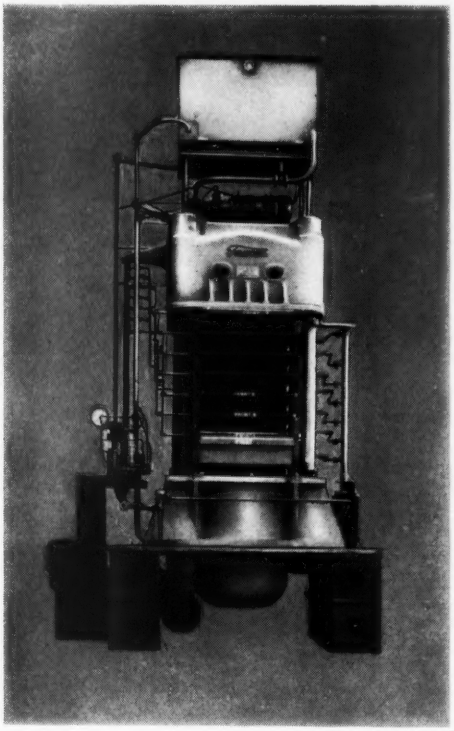
E. Elliott LIMITED
THE MOULDERS WITH THE ENGINEERING BACKGROUND



Head Office & Works: 315, SUMMER LANE, BIRMINGHAM, 19. Tel.: ASTon Cross 1156/7/8/9

hydraulic presses for the rubber and plastics industries

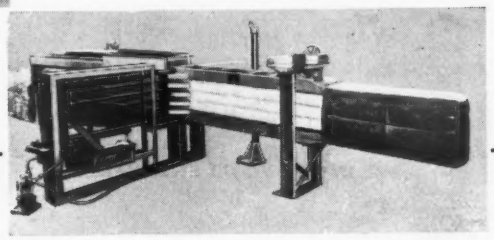
Right:—A Fawcett press for veneer and plywood. Easily adaptable for other materials. Made in various sizes as required.



The ever increasing part played by the rubber and plastics industries in modern economy has lead to a corresponding development in processing plant and technique. Leading the way are Fawcett Preston & Co. Ltd. who with nearly two hundred years' experience, offer a range of hydraulic and baling presses unsurpassed for reliability and efficiency.

Left:—Operated by its own self-contained pump, this 2,000-ton up-stroking multi-platen press is for pressing asbestos and synthetic materials.

Below:—A specially designed horizontal machine for baling synthetic fibres. Bales are delivered ready for transportation.



Fawcett EST 1758

Special presses designed to suit individual requirements

FAWCETT, PRESTON & CO. LTD., BROMBOROUGH, CHESHIRE. *PHONE: ROCKFERRY 2201 (5 LINES)*

P4625

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Vinatex Limited manufacture a complete range of Polyvinyl chloride compounds which can be supplied in the form of chips, slabs or uniform pellets.

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We make compounds for... Petrol resistant extrusions. Non-toxic extrusions. Rigid anti-shatter extrusions. Dielectric, direct insulation and sheathing purposes. High clarity extrusions. General purpose extrusions. Gramophone records.

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7678923008
2129765
2345

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Do you think in **Millions?**

WE do. We work in millions. Moulded Plastics, that is. For example, we mass produce millions upon millions of Platignum Fountain Pens annually. And that same meticulous precision goes into all our intricate mouldings. Our delivery service too, is exceptional; we guarantee the best timetable in the business.

If you have a plastic problem — whether in millions or dozens — we are the people to help you. Send us your enquiry or tell us a convenient time to call.

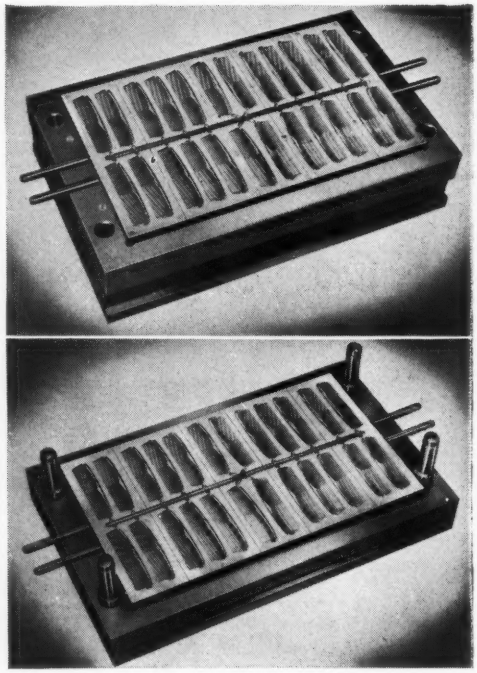
we are **Mentmore Plastics**

MENTMORE MANUFACTURING CO. LTD., 1, BRADLEY ROAD, WOOD GREEN, LONDON, N.22. TEL: BOWES PARK 6021/3

another **Platignum** enterprise

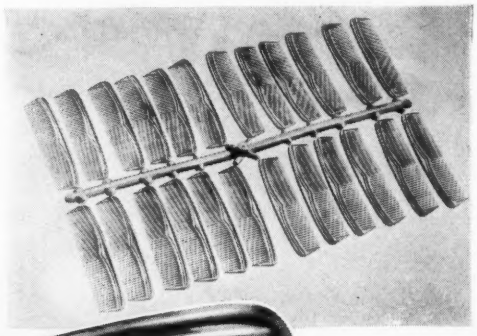
Be PRECISE with plastics

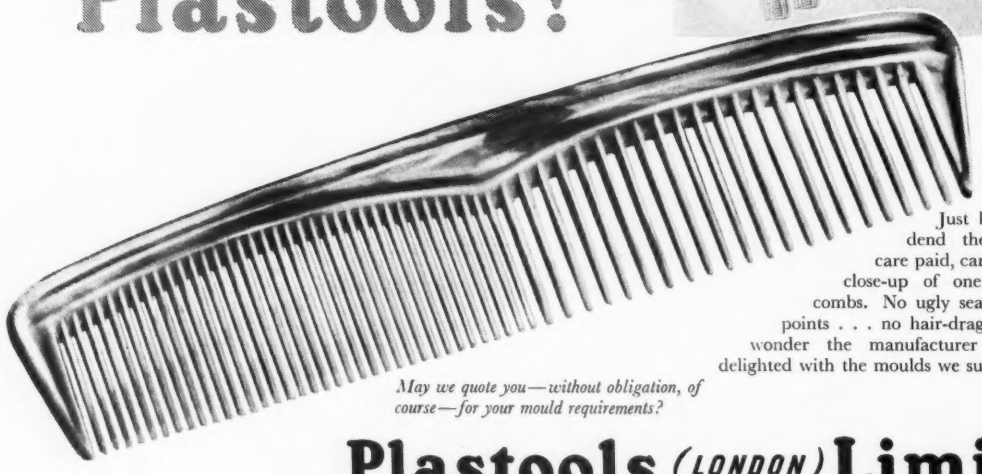
How accurate can a plastics mould be? . . . as accurate as you'll ever need if you insist on *Plastools* moulds! That is because Plastools craftsmen take the utmost pains over their products — whether the resultant moulds are intended for the individual production of luxury goods or for the mass manufacture of strictly low-price articles of everyday use. *This isn't a boast—it's a fact!*



Here are the male and female parts of a mould we made recently for a plastic comb manufacturer. Even for an ordinary "run-of-the-mill" product like that, our moulds were exactingly fashioned down to the very last detail.

use moulds by Plastools!





Just how great a dividend the extra Plastools care paid, can be seen from this close-up of one of the finished combs. No ugly seams . . . no weak points . . . no hair-dragging snags: small wonder the manufacturer was so wholly delighted with the moulds we supplied.

May we quote you—without obligation, of course—for your mould requirements?

Plastools (LONDON) Limited

ALBANY LODGE · FOOTS CRAY · SIDCUP · KENT · Telephone: FOOTS CRAY 4514

For electrical purposes laminated plastics have to be fabricated into many shapes and forms. Here are some examples of moulding and machining in Paxolin and Panilax.

m and i

THE MICANITE & INSULATORS CO. LTD

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BRANCH OFFICES at BIRMINGHAM · CARDIFF · GLASGOW · MANCHESTER and NEWCASTLE-UPON-TYNE and representatives in most countries throughout the world. In CANADA, MICANITE CANADA, LTD.

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DETROIT PUBLIC LIBRARY

Polythene in the home

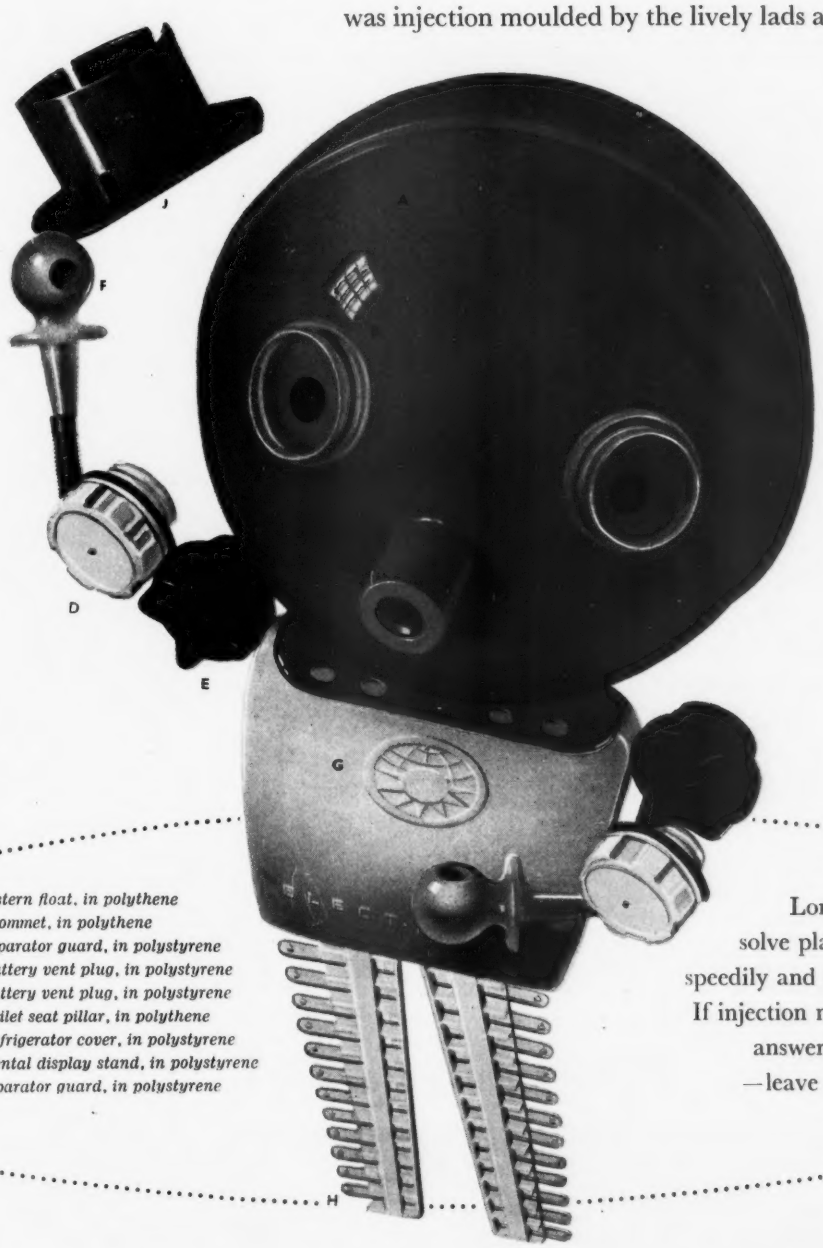
Polythene celebrates its 21st birthday with a reduction in price. Polythene has the lowest s.g. of any plastic in the world, and it is now the most economical. It is ideal for such diverse purposes as kitchen bowls and innumerable other domestic articles, submarine cables, cold water tubing and packaging film. Polythene was discovered and developed — and is sold under the trade mark 'Alkathene' — by Imperial Chemical Industries Ltd., London, S.W.1.

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON S.W.1.

ICI

P.580

He's a model character... Every bit of him plays its role in products by well-known manufacturers. And every bit of him was injection moulded by the lively lads at Lorival.



A *Cistern float, in polythene*
B *Grommet, in polythene*
C *Separator guard, in polystyrene*
D *Battery vent plug, in polystyrene*
E *Battery vent plug, in polystyrene*
F *Toilet seat pillar, in polythene*
G *Refrigerator cover, in polystyrene*
H *Dental display stand, in polystyrene*
J *Separator guard, in polystyrene*

Lorival designers solve plastic problems speedily and economically. If injection mouldings can answer *your* problem —leave it to Lorival!

LORIVAL PLASTICS

L53

UNITED EBONITE & LORIVAL LTD., LITTLE LEVER, NR. BOLTON, LANCS

BOWATERS PACKAGING

Come to the Fair!

MAKE A NOTE now (if you haven't already done so) to look in at Olympia for The Packaging Exhibition. This year's show looks like being brighter, busier and bigger than ever, with Stands in both National and Empire Halls.

There's much to see, much to do. It's a time for meeting old friends and making new ones. It's also a time to look around, an opportunity to see what's new in this lively, colourful, forward-looking industry.

And there are plenty of new things to see on the Bowater Stand on the ground floor of the Empire Hall. A brand-new fibre drum and Britain's first-ever tear-strip corrugated case are two big attractions of a display which also includes the latest refinements in multiwall sack design, the first public showing of the Bowater range of sack weighing, filling and closing equipment, new bags and many colourful and protective wrappers.

They're all worth seeing. Come along and take your pick from the up-to-date ideas on display at the Bowater Stand — No. 8, Row S, Empire Hall.

For the benefit of those who cannot get along to Olympia and as a guide to those who can, here is a preview of what Bowaters will be showing.

Beat the drum for S

A BIG welcome for this new member of the fibre drum family. It's so new that pilot-plant-production has hardly begun.

You will be hearing more about this tough young newcomer.

In the meantime, note the steel lid and locking band, the waterproof recessed base and the metal beading.

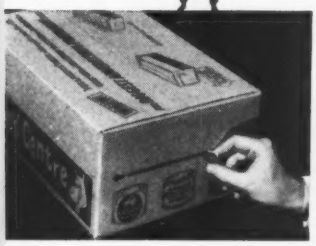
It's light, it's strong, it's rigid. Rims are protected against denting and breaking. Sides are smooth and straight — no protruding rivets or stitches.

New walls for sacks...

YOU MIGHT NOT think that multiwall sacks — basically pasted valve, sewn valve and sewn open mouth—offered a big field for development. But you would be wrong; the variations on this trio are quite remarkable.

For example, Bowaters will be showing sacks with new, hygienic *grease-resistant* inner walls — polythene coated and glassine laminated. These sacks are already being used for dried milk or desiccated coconut. And there are plenty more uses for them not only in the food manufacturing field but also in the safe, clean, economical packing of high-grade pharmaceutical chemicals, moulding and plastic powders. Bowaters

and here's the TEAR-STRIP corrugated case



Ease and speed of opening is the primary advantage of these new tear-strip cases. The case is virtually unzipped—all the retailer has to do is lift the tab and pull. Off comes the top and the contents are ready for display. No damage from knives or other opening tools; no waste of a busy retailer's time. The tray sections can be used to build displays and finally as carriers for home delivery.

THIS is a pack with a big future. As the art of retailing in this country becomes more scientific, more streamlined, this case will be used for packaging more and more groceries, toilet articles and other consumer goods. For it offers big advantages to the busy retailer—in ease of opening, speed of price-marking, display-potential, carry-home after-use, and elimination of wastage due to faulty opening.

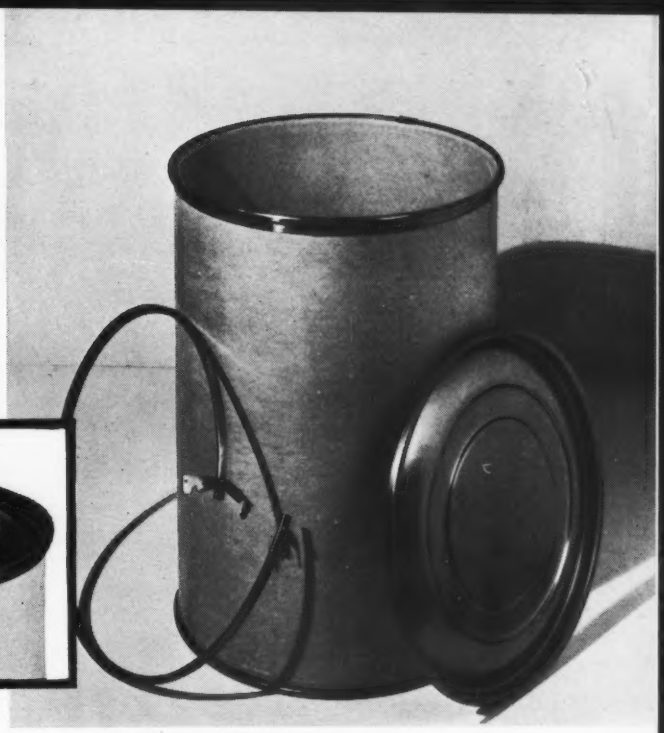
And this is only one of the corrugated case developments you can expect from Bowaters. Among other things, they're working at the Croydon factory on a wider range of weatherproof cases and a brand-new case with laminated fluting, offering even greater protection for concentrated loads.

BULLETIN

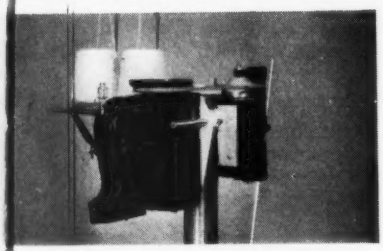
for SUPAKASK

It's a drum to bear in mind when you're thinking of heavy-duty export work.

The steel lid of the new Bowater Supakask, with its locking band and pilfer-proof clips, is smooth and tight. (See inset). But it's easy to open and close and no vacuum is created when the lid is lifted. Makers of flocculent powders, please note.



ave some ideas themselves. Have you ome you'd like to talk over?



...with machines to fill and close them

SEE THE STRENGTH — and efficiency — of the machinery designed and supplied by Bowaters for the filling of multiwall sacks. They pack all kinds of free and semi-free flowing materials with superhuman accuracy and speed.

And don't go without seeing *The Best Sewing Head in the World* — the Union Special Sewing Head. By arrangement with the main British distributors, Bowaters are the only paper sack manufacturers in the United Kingdom to supply this robust machine, which provides certain, secure closure for sewn open mouth sacks. (See illustration above.)

Bags of scope

FEW PEOPLE in this country could supply a complete catalogue of the commercial uses for paper bags. Bowaters know quite a number of them since they produce millions of paper bags every year — bags of white papers, kraft papers, greaseproof, glassine and cellulose film, waxed and laminated, plain or printed. They know, from experience, that many branches of industry and commerce have found in the many developments of the once-humble paper bag, simple, economical methods of packaging for small but important items which have hitherto been packaged inadequately or not at all.

You tell us

What Bowaters do not know—for certain — is to what extent the use of bags can be extended in your particular field. Maybe some of the products which you pack in small quantities could use the grease resistant, semi-transparent glassine and glassine laminated bag. Or, perhaps you're making a hygroscopic powder that demands the protection from Water Vapour Permeability that waxed bags offer.

It is a safe assumption that, whatever your particular interest, there are undiscovered uses for one or other of the forms of paper bag now available.

In this spirit of challenge, Bowaters will welcome your enquiries on any aspect of packaging by bag. Come and talk it over with the man on the spot.

Wax works in colour

DRESS YOUR GOODS up in their finest of clothes . . . and what better than wax wrappings to do a big selling job for your product wherever it appears?

Believe it or not, some people still think Bowaters print *on* waxed paper. They don't. They print on the base paper which is then passed through the waxing bath. That operation can't be shown on the stand but what you will see are specimens of multi-coloured printing by the gravure, letterpress and aniline processes on waxed wrappers that Bowaters are supplying to some of their customers.

Colourfully printed wax wrappers take some beating for sales-appeal. The smooth wax coating adds its own glossy lustre to the rich tones and mouth-watering realism of first-class printing. And you know, of course, that wax protects, keeps in freshness and flavour and guards against contamination.

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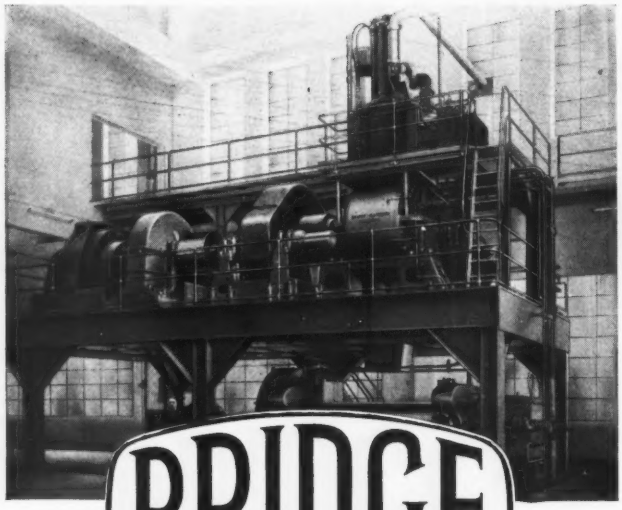

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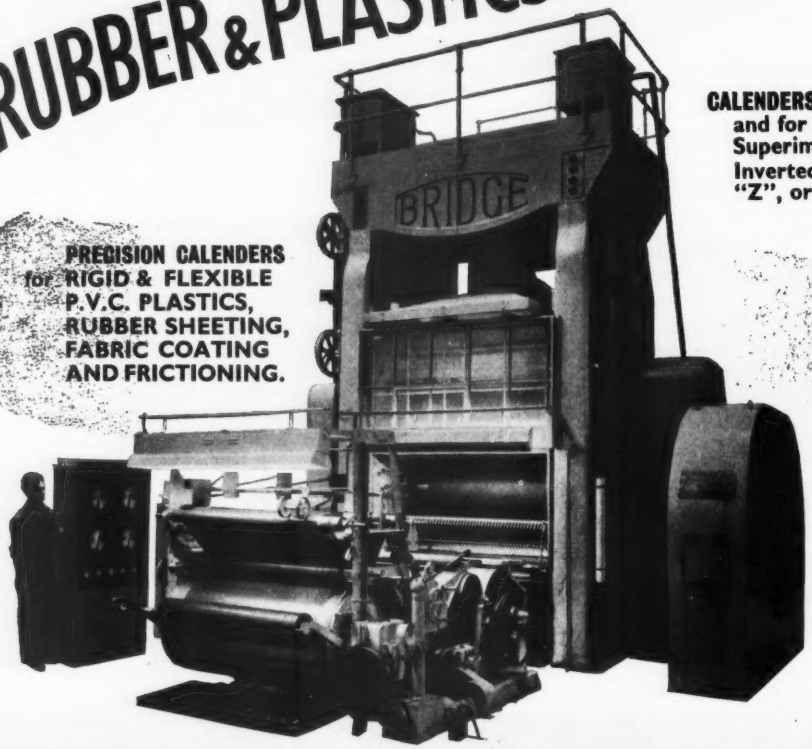

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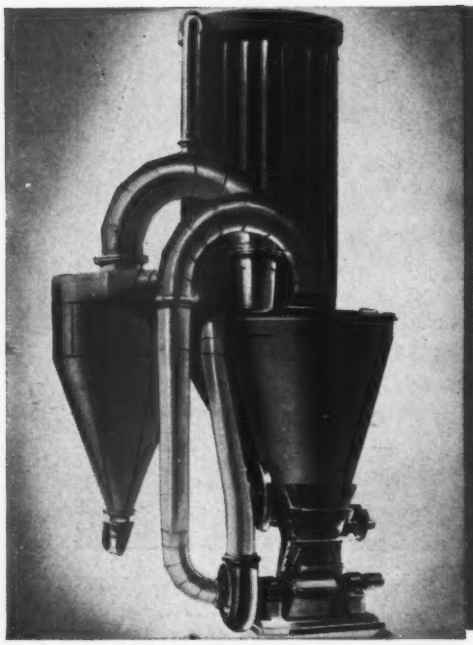

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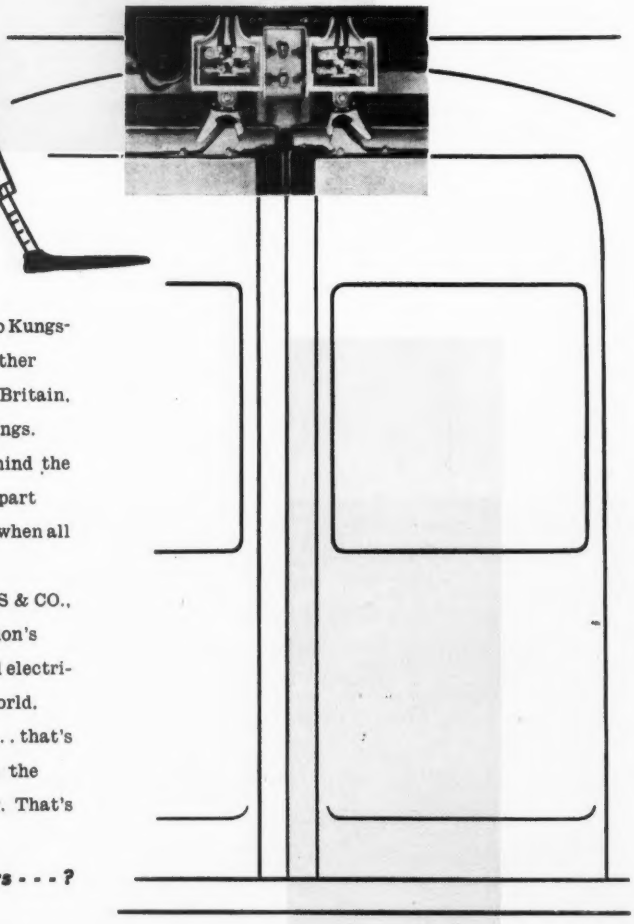

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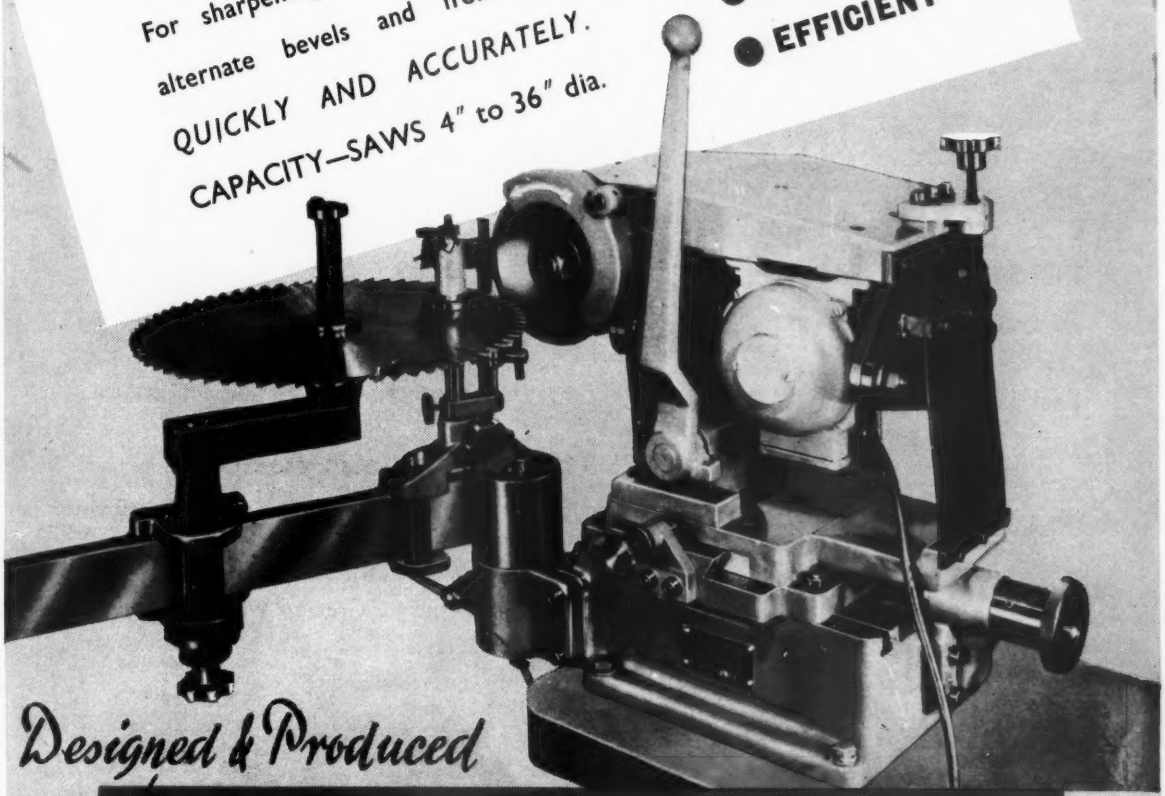

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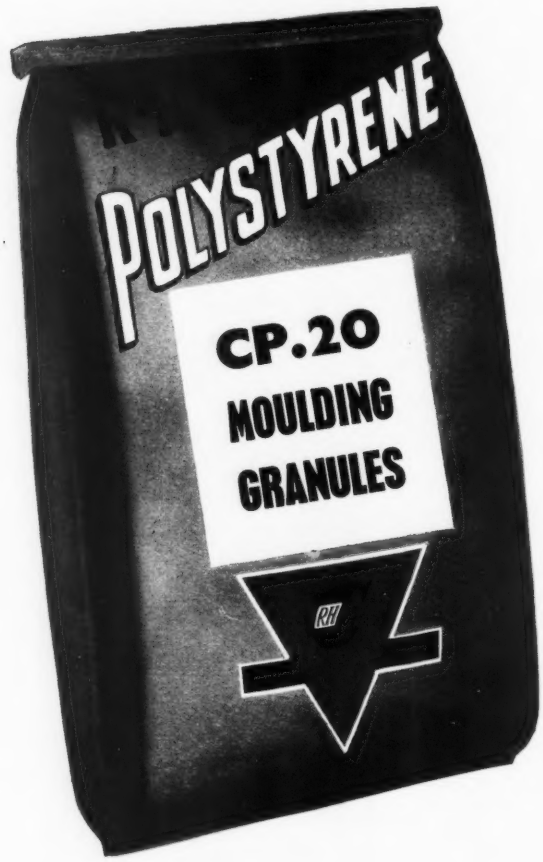

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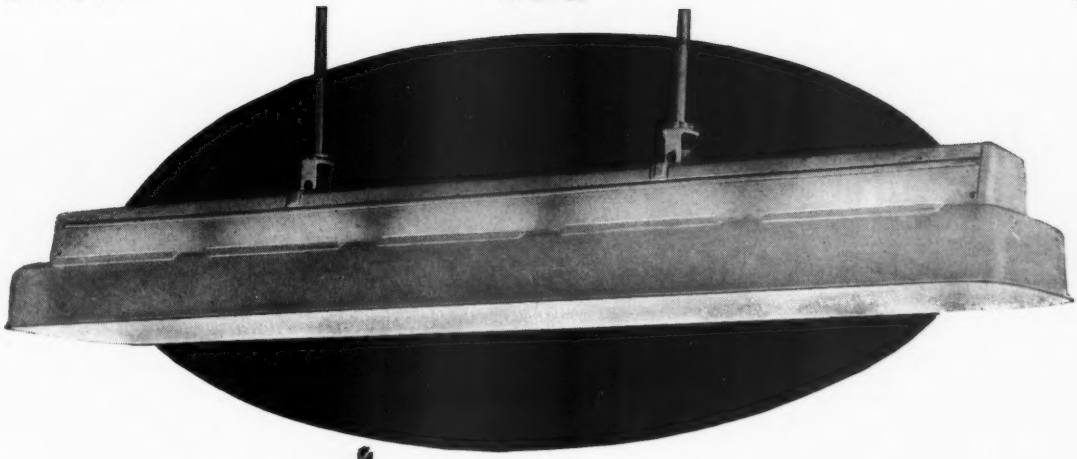

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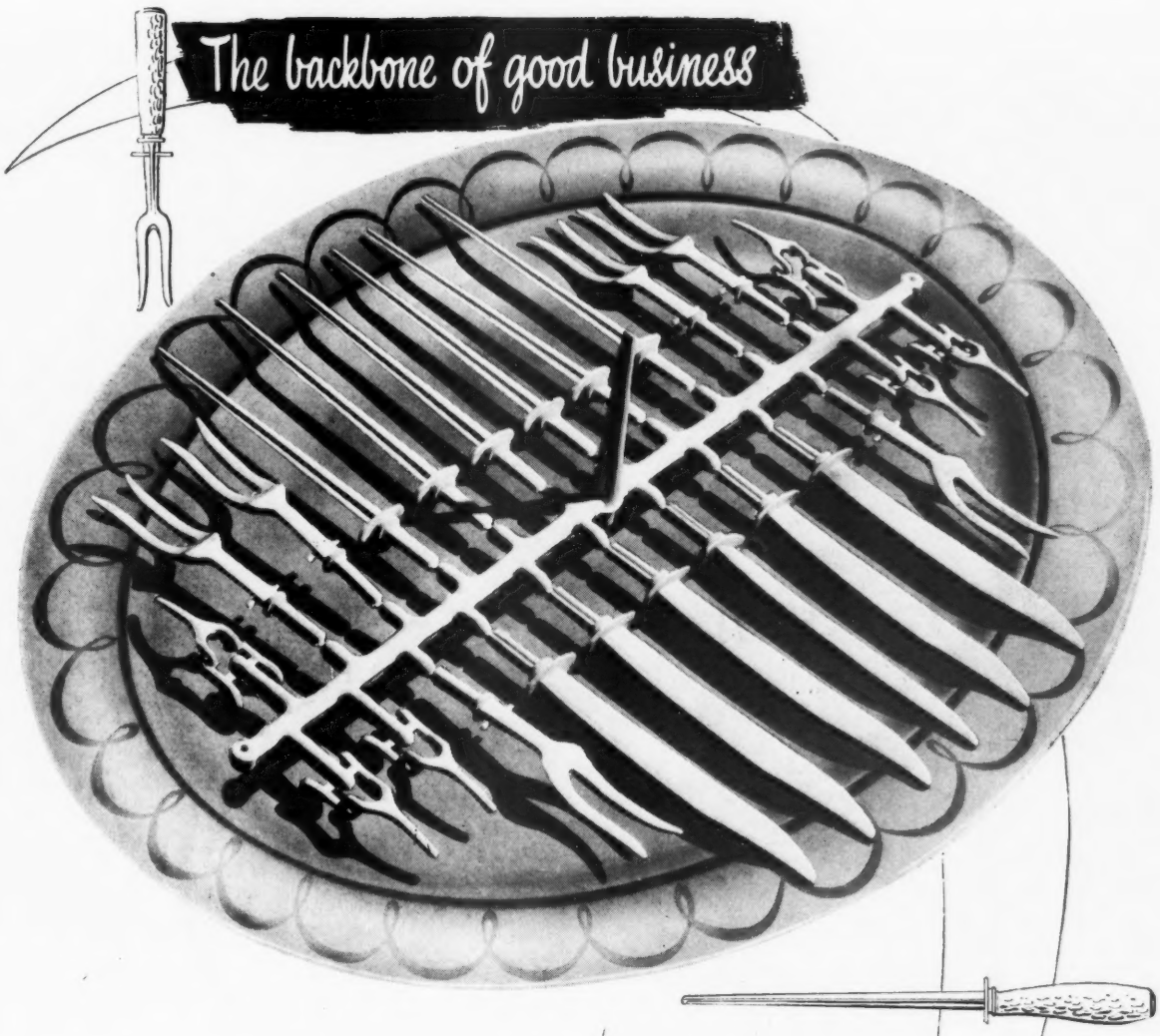

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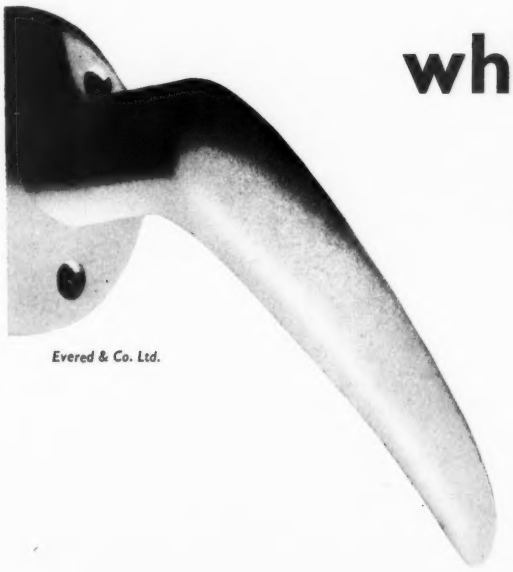

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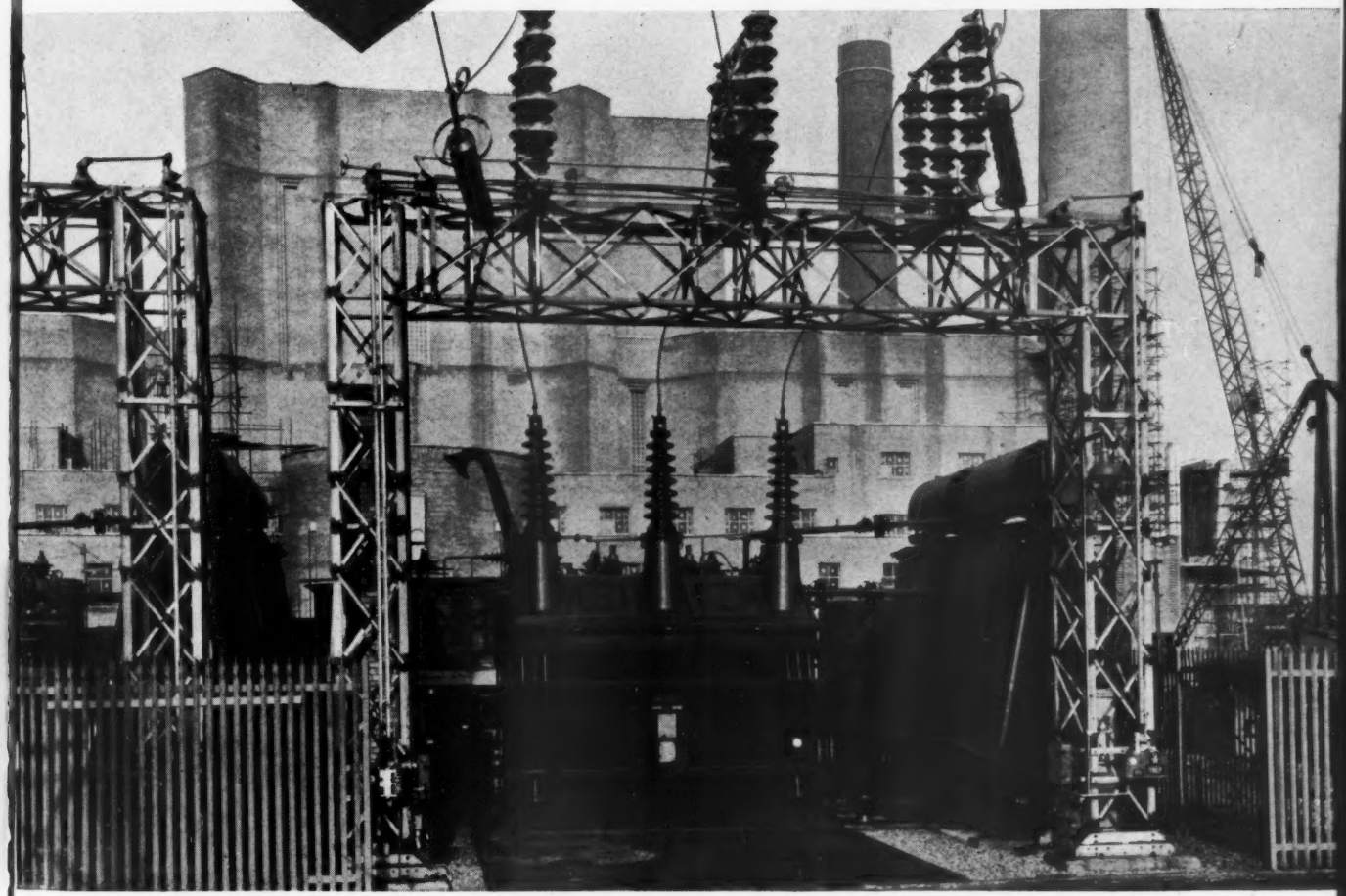

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P85

Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PROPRIETORS: TEMPLE PRESS LIMITED

CHAIRMAN and MANAGING DIRECTOR: ROLAND E. DANGERFIELD

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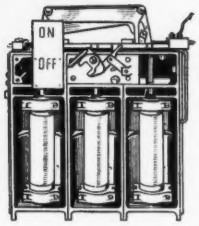
The 20-ft. Dory built for the Admiralty by W. and J. Tod Ltd. of Weymouth, shown here at the National Boat Show held in London this month.

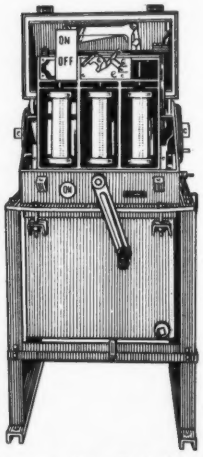
NP13

Illustrations by courtesy of J. G. Statter & Co. Ltd.

The Plastics Moulding



The Fuse Carrier with tripping mechanism and fuses



The complete Switch with Fuse Carrier raised for inspection

where plastics really matter

In the "Metalclad" Oil Fuse Switch made by J. G. Statter & Co. Ltd., the FUSE CARRIER is a plastics moulding made by National Plastics from 'phenolic' material. Some notion of the sturdiness and reliability of this moulded component can be gained from the fact that this type 'VL' Switch is used by Electricity Supply Undertakings and large industrial enterprises for voltages up to 13,200 and 250 MVA rupturing capacity. Here is yet another proof that National Plastics have won an important place in British industry.

NATIONAL PLASTICS (Sales) LTD

Sales organisation for British Moulded Plastics Limited

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Plastics

VOL. XX. No. 210 JANUARY, 1955

EDITORIALS

1954—And After

WITH the December, 1954, number of *Plastics* we published the 53rd issue of our five-year-old feature "Plastics in the Service of Man." When it first began we presumed it would prove an occasional feature only, for it seemed highly improbable we should be able to gather together in one hurried month some four pages of photographs of mouldings and fabrications that had been made for one special outside industry and to continue for different industries without remission. Such is the diversity of our own industry, and such is the collaboration we have received from moulders, fabricators and general readers alike, the publication has continued, with a few interruptions by special numbers and so on, as a continuous stream. To date, we have dealt with the service the plastics industry has rendered to some 25 different spheres of industrial and domestic life. And so far as we can see the tale is not yet ended. Clearly these special pages were never intended for the edification of the plastics industry itself. They were to act as propaganda, pure and simple: to show the world what the British plastics industry had done, and to stimulate trade. This has indeed been the effect, for many hundreds of inquiries from readers, agents, and industrialists from literally the four corners of the earth have been received and the results have often been pleasing to both inquirer and manufacturer.

As a slight change in our routine we have considered it appropriate to remind our readers of some of the highlights of the past year by publishing instead, for this month only, a number of photographs and notes under the title "Scrapbook for 1954"—which, while indeed is but a concentrate of the regular feature and of other facts, pinpoints to a greater degree a year of significance in the progress of our industry.

Since our moulders and fabricators live on the stream of raw materials that emanate from the factories producing them, the changes in such factories are of prime importance. Certainly many striking changes have taken place in them in 1954, or at least culminated in that year by completion or partial completion of new units which were able to take their part in achieving an overall all-time record of 200,000 tons. By the end of 1955 the production capacity will be surpassed if things proceed normally, although it is believed that in one or two fields even the increased capacity will not satisfy the growing demands in home and overseas markets.

As for the new things that have been made from these raw materials, and the new machines that are produced for their conversion, the "Scrapbook" is sufficiently eloquent. There is possibly more than a touch of pomposity in the expression "in the service of man," but who will gainsay its essential truth when we consider the whole field of raw materials, the old vis-à-vis the new, and the impress plastics have made upon the world during the past 20 years.

New Plastics

THE year 1954 also found a prominent scientist in the plastics industry suggesting that there appears to be a limit to the number of new types of plastic materials that can be produced. This by no means infers that chemists cannot do so—the theoretical number is "unlimited"—but that by and large it may not be sufficiently economical to do so since the new will probably prove to be but slightly different from existing ones. Furthermore there is ample scope in modifying the ones we have to get as much variety as we shall require for many years to come.

In essence such modification has taken place since the plastics industry first began and in modern days we have seen the changes possible in p.v.c. and polystyrene. With the first named we may copolymerize to produce compounds of different properties. Or by varying plasticizer content we may obtain a large number of compounds varying in hardness. We may even in the one piece have a soft portion and a hard portion by removal of part of the plasticizer or produce a similar result by welding. In the case of polystyrene we may modify by mixture with other organic compounds such as rubber or copolymerize styrene with other monomers. Again as we indicate elsewhere, the limited production of polytetrafluorethylene is being augmented by new and close relations, polytrichlorfluorethylene and polytrifluorchlorethylene.

If we still have a long way to go in our experiments with the materials we have, there is an even longer way to go in making new components from them, for every month brings evidence that we have merely scratched the surface of application. It is difficult now to be surprised in the plastics world, but it is, nevertheless, exciting to encounter, as we have in one week, a new steel fan the vanes of which are coated with a soft and hard p.v.c. laminate, a nylon-link conveyor chain in which metal rods fitted in the nylon links distort under tension before the nylon, and a sphere of glass-fibre/resin replacing a metal sphere used in aircraft for the supply of compressed air under 3,000 p.s.i.

Whether we shall ever be able to cross-link our simple long-chain plastics and so produce thermoset materials from our thermoplastic mouldings in our own little atomic reactors or in our own radio-active isotope store in the backyard, so to speak, we do not know. It's an exciting thought, nevertheless, and if we could by the same means cross-link polyesters without the aid of styrene and peroxides we should be relieved of a number of headaches and obtain structures that might prove of even greater value.

Just to bewilder us, news came through in December of a group of new thermoset copolymers emanating from Peterlite, Ltd., an associate company of Combined Optical Industries of Slough. These materials are transparent and colourless and have a high degree of resistance to heat and chemical reaction. Perhaps the "tail" of plastics will be longer than we expect.

New Machines

"SCRAPBOOK FOR 1954" also shows some of the new machines that made their bow in that year, and some of the old that have been redesigned to achieve greater all round efficiency. Advances are noted in all forms whether they are the ancillary pelleting machines or injection, compression and

extrusion machines; we welcome especially the high-speed type for moulding the new alkyd resins—the latest to appear is now described on page 24 of this issue of *Plastics*.

The newest machine which has received widest acclaim, because of the need in a sphere of application that can so readily expand, is the vacuum forming machine. While claimed to be a quite new branch, vacuum forming has long been known although little practised. It is, nevertheless, of considerable importance and several engineering companies, experienced in vacuum technique, have made great progress in their production. The most recent of them, the twin type of Formvac, we saw in December at the Paris Exhibition where it created something of a sensation because of its size and the size of sheet it can deal with, and because of its large measure of automaticity. It is a press-button achievement. It is, as was expected, much more expensive than those already known on the market. But if it proves, as it is clearly presumed to prove, competitive to the very large injection machine, the economies possible are formidable. No doubt even the Formvac is not the last word and improvements are possible from its own engineering shops and from others. Vacuum forming cannot pretend to achieve the perfection of moulding to exact precision as does injection but such precision is not always important. Its impact in various fields is powerful and growing and with proper analysis from the economic and technical points of view will find its place in industry.

Improvement will also come with improved sheet (high quality is a *sine qua non* for good results) and widened markets will appear with new laminated sheeting. And finally, we can envisage the future complete unit: sheet producing extruder feeding directly to the vacuum forming machine, the "cut-offs" being returned to the extruder.

MOULDING POWDER AND SHOT

Recovery Plant Opens

Spent a most interesting day recently at the new works of R.H.C. Reclamations, Ltd., at Harpenden, a creation well after my own heart since in it I see the fight against waste of good plastic material carried out on the principles of sound economical research and of technical worth, at a new high level. The recovery and reclamation of thermoplastic materials carried out here may be considered parallel with that performed for normal scrap but it is clearly different in that none of the raw material emanates from the injection moulding shops. It largely consists of sheet and other forms of, for example, cellulose acetate and polythene, that undergo little or no use before reception into the factory. Since further treatment comprises a specially devised washing process, mixing, extrusion and converting to pellets we have a welcome source of reasonably high-quality material that might otherwise be lost to the industry. My congratulations to the directors of R. H. Cole and Co., Ltd., the parent company of the new organization which may well set a new high standard in this important business of reclamation.

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Man Bites Dog

A so-called hot bit of news comes to me through *Advertisers Weekly* to the effect that U.S.A. manufacturers are incorporating plastic gramophone records in breakfast cereal packs—a development which is being watched closely in this country. It's no news to me; at least judging from the taste, I've always suspected the presence of ground p.v.c. and shellac. What would be *real* news would be an announcement that cereal foods are being incorporated by moulders into gramophone records. We could publish that under "New Productions."

◆ ◆ ◆

Plastics v. Metals

There is no doubt in my mind of the attitude of the metal industry today towards the plastics industry. It rightly regards our products now as being directly competitive and is taking steps to offset the danger. One well-known British technical journal says, "Let us, in the world of non-ferrous metals, resolve . . . to inter once and for all that namby-pamby nonsense talk of friendly rivalry. . . . We refer, principally, of course, to that rivalry which exists between metals and certain non-metals." A significant sentence is also published in "Metal Statistics," 1954, by the powerful German organization Metallgesellschaft A.G., ". . . the use of plastics is rapidly increasing and they are usurping many provinces of application hitherto exclusively held by non-ferrous metals." So let us give up apologizing for the growth of plastics and saying that they are not substitutes but are merely complementary to traditional materials. It's merely playing with words with one's tongue in one's cheek. Plastics are complementary in the sense they are new materials for construction and they can be used complementary to metals in the sense that they can occasionally enhance the value of metals by protecting them. But they often replace them and oust them when special properties demand and are therefore substitutes. "Usurp" has a nasty sound to it, but if, for example, we can replace as has been done, the metal sphere mentioned in the previous page by a glass-fibre/resin sphere which is a fraction of the weight and yet can stand up to a working pressure of 3,000 p.s.i., then let us do a lot more usurping. We can stand the horrid shame of it.

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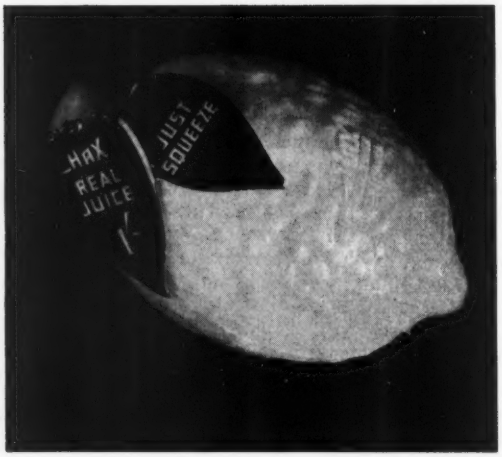
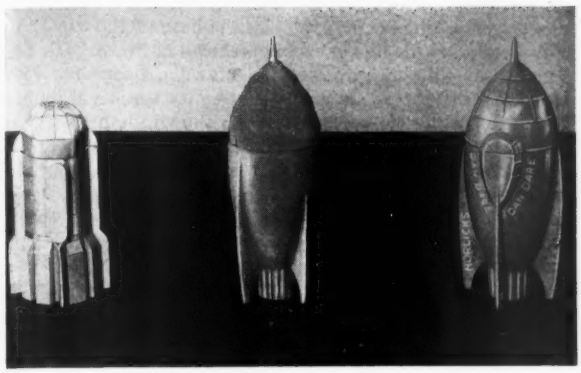
The Answer's a Lemon!

I love bright ideas that show the sparkling mind of an inventor even in small things, and the polythene bottle seen below comes under this heading with a bang, for it is shaped like a lemon, looks like a lemon in its colouring and pendant leaves, and contains real lemon juice. This will be a real boon to both housewife and professional cook, for with its perfectly leak-proof stopper and squeeze-spray action, it is exact in delivery and supremely economical without the mess attendant on squeezing real lemons, because every drop is available and can be stored over prolonged periods. It is obviously the ideal thing for cocktails, pancakes, sole bonne-femme and escalope de veau, and, finally, your wife can squirt a few drops on her hands to recover their pristine whiteness after cooking operations. This winner comes from the prolific Cascelloid Ltd. stable in Leicester.

DOGSBODDY.





Moulding for Premium Advertising

New business for moulders may result from sponsored television. This article describes an injection moulding which is coupled with a Radio Luxembourg programme. The three stages in its development are seen in the photo, left, Fig. 1.

THIS year will see the introduction of independent television, a development which has caused much public controversy since for the first time broadcasting in Britain will be coupled with advertising. The precise form the advertising will take is still in some doubt, and many people have expressed the hope that broadcasting will not assume the American pattern, where programmes are understood to be interrupted every few minutes to enable the "sponsor" to direct the viewers attention to this product or that. Whatever the form, however, independent television is bound to stimulate an already thriving business, premium advertising.

More commonly connoted "give-away" advertising, the function of premium advertising is to increase the sales and popularity of products by means of distinctive gifts. The forms these gifts take are diverse; the launching of a new soft drink may be accompanied by the free distribution of badges for children, or a free mug given away with every tin of a new drinking chocolate. Of recent years the trend has been towards qualified "gifts," that is to say that a charge has been made which, in fact, bears no relation to the actual cost of the gift, but which enables the advertiser to offer his customer an article of some practical value.

The relation of plastics to "give-aways" dates back to the early 1920s and until the last war accounted for a very considerable volume of moulding business. With the easing of the economic situation the past two or three years have seen a resurgence in this field of moulding, and indeed an extension involving other fabricating techniques such as the manipulation of acrylic sheet and vacuum forming. A review of the contribution of plastics to this field was published in the September and October issues of *Plastics* for 1953 and stimulated considerable interest.

The Impact of Commercial Television on the Plastics Industry

The plastics industry can, therefore, expect to receive many inquiries during the next few months from programme sponsors for moulded items suitable for premium advertising. We should imagine that they will be similar in some respects to those already used by advertisers on Radio Luxembourg and one company at least, E.V.B. Plastics, Ltd., of Horley, Surrey, is paying close attention to this potential development.

E.V.B. Plastics have for the past seven years been mainly concerned with the injection moulding of toys and only in recent months has the company turned its attention to the advertising market. This has been very largely due to the managing director, Mr. L. A. Barnes, who has made a name for himself as an original design specialist. Having had an early training as an industrial designer and draughtsman, he found a fruitful field for his ideas in the toy industry; recent visits to the United States and Canada have confirmed his original viewpoint in that a great market exists for quality moulding in conjunction with television and radio programmes. The audience that is reached by such broadcasts is so large as to make moulded items essential if the demand is to be met economically.

Horlicks "Space Cup"

As an indication of the form which this new development may take, it may be of interest to trace the development of a project now handled by E.V.B. Plastics in conjunction with Horlicks, Ltd. Horlicks have for some time run a programme called "The Adventures of Dan Dare" on Radio Luxembourg in serial form; part of this is devoted to children who become members of the Spacemen's Club. One day Horlicks received from a schoolboy in Brighton, who was a member of the club, a cardboard model of a space ship, which, he suggested, might be given away in the form of a drinking cup. Horlicks were at once impressed by this idea and E.V.B. Plastics were approached as possible moulders of the

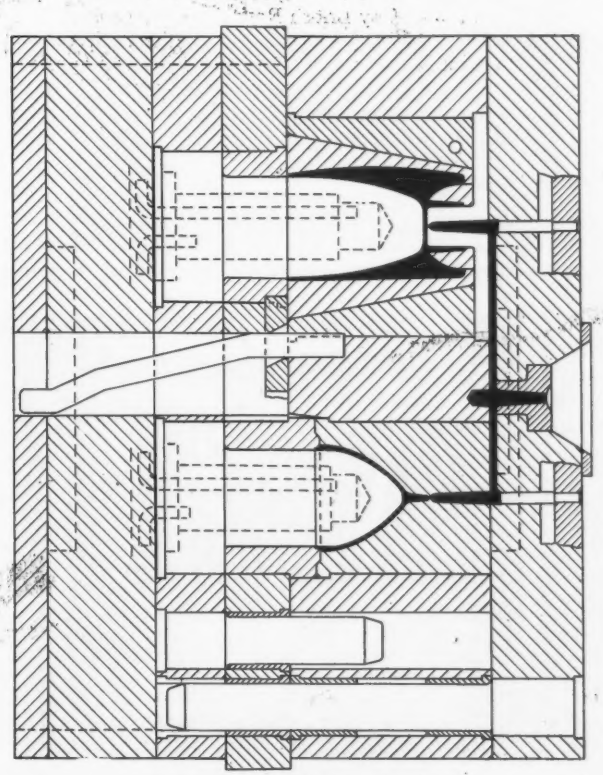


Fig. 2. A diagrammatic cross-section of the four-impression tool.

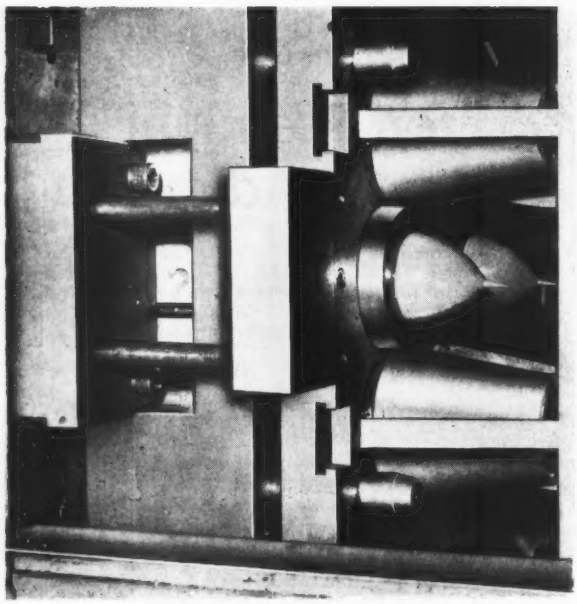


Fig. 3. A side view of the tool, open. The splits for the body can be seen top and bottom. The lids are seen in the centre.

cup. The schoolboy was rewarded with a cheque for £50 and a bicycle.

In Fig. 1, can be seen the three stages in the development. On the left is shown the original cardboard model, in the centre is the prototype fabricated in acrylic sheet, and on the right is the production version, moulded in medium impact polystyrene supplied by British Resin Products Ltd.

Mr. Barnes was responsible for the translation of the original idea into a feasible moulding. The prototype was approved by Horlicks and tool drawings were then prepared by the company's mould makers, Moulding Equipment, Ltd., Poyle Trading Estate, Colnbrook, Bucks. Costs having been agreed construction of the tool was then commenced.

Tool Design

This tool will have particular interest to injection moulding specialists, since it incorporates a number of novel features. As will be seen from Fig. 1, the moulding calls for four deep vanes, necessitating a split tool for the base of the cup and a cross-section of the tool assembly is shown in Fig. 2. The cam action, seen in the centre of the drawing, opens the splits after the stripper plate has brought away the sprue and runners from the barrel nozzle. At the top is shown the moulding of the lower half of the unit and at the bottom is the lid. The pointed antenna of the latter is ingeniously contrived by making use of the runner. The size of the moulding would normally necessitate a press daylight of at least 10 in., but as will be seen from the drawing, the difficulty of removing sprue and runners, owing to the restricted daylight available, has been overcome by running the tool hot, so that the material remains soft enough to be stripped out by the operator with the aid of a hook.

A close-up view of the four-impression tool can be seen in Fig. 3, demonstrating the use which has been made of the available platen area. In the centre can be seen the two cup tops and above and below are the splits for the cup base. Fig. 4 shows the upper set of splits open, the moulding about to be extracted. This photograph was taken standing on top of the machine, looking down into the tool assembly. At the bottom of the photograph can be seen the end of the sprue. A general view of the moulding shop is shown in Fig. 5, the cup being moulded in the second of the two Peco 8-oz. machines shown in the left foreground.

Finishing and Packing

On ejection from the press the moulded components are passed immediately into a finishing bay where they are inspected and subsequently packed for direct dispatch to the recipient. Inspection is an important feature although the tool itself has been designed to operate with the minimum of post-moulding operations.

Although concentrated only in the thermoplastic field, the company makes use of a wide range of materials, including nylon and polythene. Provision is made for the colouring of virgin powder and the re-working of scrap by the installation of a Windsor extruder. After cooling, the material is granulated ready for moulding.

The company has moved considerably since its early associations with the toy industry. With the advent of sponsored television and with the assistance of the design service which the E.V.B. Plastics Ltd. now makes available, the company is in a position to expand considerably and to cement its relationships with the plastics industry proper.

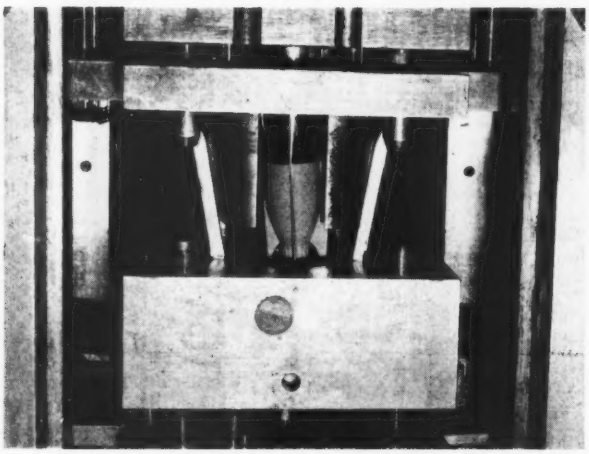


Fig. 4. A view taken from on top of the injection machine. Here the splits can be seen opening, the core being withdrawn from the body moulding.

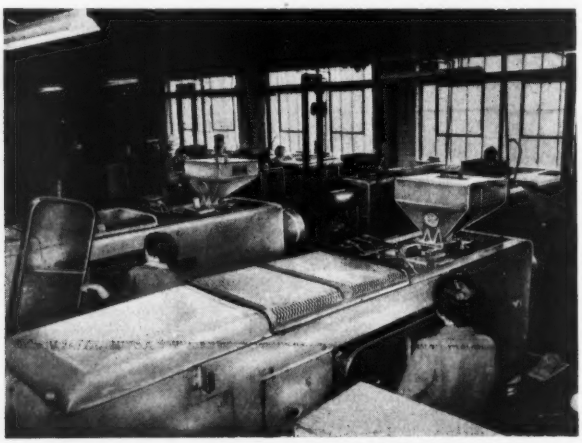


Fig. 5. Two Peco 8-oz. machines are shown in the foreground. One of these is used for the Horlicks mouldings. The factory is undergoing extensions.

Paris Plastics Exhibition

ABOUT four or five years ago a noted French scientist and technologist said to the present writer, somewhat despondently, " There is no French plastics industry; " a somewhat similar sentiment has been expressed in a technical journal. This is clearly one of those statements permissible to an internal knowledgeable critic, and basically we believe it is exaggerated, as such statements often are, when we remember that France always was and still is in the front rank of scientific attainment and that technology has long been the subject of intense wide study—to a much greater extent than it has been in Great Britain and most other countries, excepting Germany and the U.S.A. (after the 1910s). We have only to look at some of the famous names in the raw material manufacturing field and their work: Rhône Poulenc, Etablissements Kuhlmann, Péchiney, Bakelite, St. Gobain, Shell, and so on to realize that most of the chemicals and plastic materials are available within the country, that while coal is not exceptionally abundant, few countries can vie with France in the matter of power from her magnificent achievements in the hydroelectric field; advances have been made also in the production of chemicals from petroleum.

We can also remember that France was among the earliest in the plastics field, a century of moulding and fabrication lies behind the workers in the great centre at Oyonnax in Ain and that there exists an organization like Manufactures d'Isolants et Objets Moulés (M.I.O.M.) outside Paris that has operated for about 50 years and is, one would imagine, as big as the biggest in this country. They were moulding plaques of Napoleon and other famous figures in 1910 from wood-flour and blood albumin (this French invention goes back to 1855), so that we presume M.I.O.M. knows something by now of moulding technique. There are also large groups in Paris, Grenoble, Lyon, Le Mans, in the Dordogne and elsewhere.

Having said this, however, we can well imagine the attitude of the scientist and the technologist who now sees what he considers far too great a proportion of small, very small moulders, churning out year by year vast quantities of moulded fancy goods, streams of gadgets, rivers of sun spectacles and oceans of " blown " toys and other equipment for holidays by the sea. He also sees the shop windows full of radio sets covered with fantastically flashy decorations (mostly in plastics). To such observers, there seems an unbalanced manufacture: too little concentration on industrial applications with the necessary accompaniment of standards on which to base sound production and too much concentration on non-industrial application—on indeed the " trivial," without any standards whatsoever.

All this may be due to what might be called Oyonnax history (which bears a somewhat analogous history to the Black Forest toy trade or to Gablonz trade), and behind it all we believe lies the exceptionally strong national characteristic of intense individuality. Certainly the number of small moulding and fabricating concerns, with the limitations of difficulty of expansion in a world of bigger and more expensive machines, is much larger than in Great Britain and many other countries, and there is very little cohesion between them. Thus, on the whole, the British plastics industry is clearly more vital, more coherent, and appears more worth while on the face of it, than does the French industry. On the other hand, it may be that France, still leading the world in so many of the desirable things of civilization, in haute couture, perfumes, tourism and good food, considers more than perhaps we do that the public market is the most important of all, and the most profitable.

To the outsider there appears therefore to be some sort of division in the plastics industry which is brought out more forcibly in the two Paris exhibitions, both held at the magnificently placed Parc des Expositions at the Porte de Versailles, 20 minutes by Metro from the centre of the town.

The Foire de Paris is held every year and everybody in Paris goes. In form it appears to be a cross between the Festival of Britain and an enormous Nottingham Goose Fair with a tang of Castle Bromwich, for there is every aspect of French life to be seen—you can buy the latest cooking stove, go down a " real " coal mine, examine the latest agricultural machine, buy a five-bob bottle of perfume for your girl friend and, if you're clever, get a free sample of hot pancakes from a stall run by a famous flour miller or, if you disguise yourself as a restaurant owner, drink sufficient free champagne to make you forget all your worries. It is a very hilarious show —the B.I.F. is a morgue compared with it. There is also quite a large special section devoted to plastics but it is almost completely devoid of technical or industrial productions; all is the output of the smaller factories and of the type we have already indicated: good and bad fancy goods, gadgets, p.v.c. swimming baths for the back garden and " blown-up " sea monsters for the sea-side; some are brilliant in conception and valuable; much is as useful as a toy Eiffel Tower poorly moulded in polystyrene and gilded with paint or as attractive as a pink-coloured fruit bowl with a net-work design. The industrial observer will thus get a completely biased view of the French plastics industry if he attends this fair only.

Fig. 1. Glass fibre/resin motorcar body (St. Gobain).

Salons de la Chimie et des Matières Plastiques

Of an entirely different nature are the Salons de la Chimie et des Matières Plastiques of which three have now been held since November, 1951; the last, which we attended, was held a month ago on December 3 to 12.

It is important to note from the beginning, that the Salons are primarily organized, not by any association of chemical manufacturers or by any plastics federation, but by the Société de Chimie Industrielle, a purely scientific and technical organization of world renown, equivalent to our own Society of Chemical Industry. The Salon, therefore, possesses certain aspects completely different from both the B.I.F. and the British Plastics Exhibition. As the title indicates, it embraces all fields of chemistry and chemical industry of which plastics is only a branch, although an important one, and in reverse

Fig. 2. Jet-propelled motor car—body in "Textiglass" glass-fibre/polyester resin.

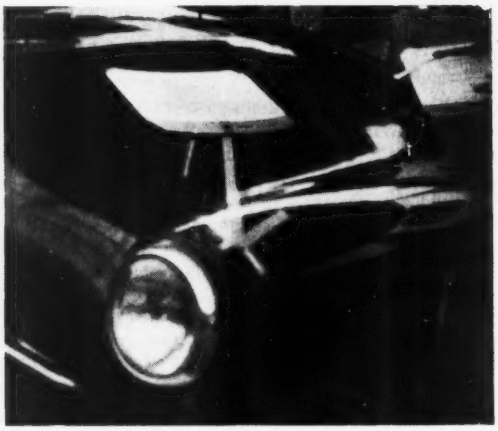


Fig. 3. View of head of the same car, driven at 40 km. per hr. against concrete post.

sets out to show and to teach the public that plastics, steel making, petroleum refining, modern use of atomic energy, leather preparation, paint making, perfume distillation, agriculture, high temperature production of precious stones and a hundred and one other industries owe the progress made in them to chemical and physico-chemical research. It is all viewed by the controlling organization, the Société de Chimie Industrielle, rather as a scientific and technical shop window for the country than as a sales promotion movement for any particular chemical industry. Doubtless most stand-holders have their own views on this matter. Nevertheless the spirit of science hovers over the whole of the Salon in a very tangible manner, and the whole feeling is further strengthened by the way in which the organizers pay homage to famous scientists and philosophers of the past (and facilitate movement at the same time) by naming the lanes in the exhibition accordingly. Thus we wandered down Allée Grignard (Midland Silicones, Ltd., would have been pleased!) into Allée Pasteur, Allée Ampère, Allée Becquerel, Allée Urbain (discoverer of activated carbon) and Allée Sabatier (who did so much of the original work on catalysis). We are sure that the young student at least would be thrilled to note those famous names that recur so often in his chemical and physics text-books. And, of course, it was just like the French to make the nice gesture to this country by naming one lane, Allée Sir Robert Mond. Perhaps we could copy the idea in this country. It would do us good to remember our past history.

The raw material manufacturers were strongly represented

Fig. 4. Four-screw Jumex extruder fitted with film-making head (S.A. Duplex).

and in this section as in past British, American and other exhibitions, the stands that drew most interest were those exhibiting glass-fibre laminates. And here also the spectacular plastic automobile and boat were generally evident. The St. Gobain exhibit was almost completely devoted to such reinforcements with an excellently finished motorcar, tanks, helmets, trays and piping. The latter was especially interesting in that the glass-fibre structures were bonded with a large variety of resins: polyesters, melamine, epoxy resins and silicones. A novel feature was an extruded polythene pipe protected by a glass-fibre/melamine cover. Another, even more "modern" car was shown on the stand of P. Genin and Cie., manufacturers of "Textiglass" glass-fibre. This was the first experimental jet automobile ever made, and it was fitted with a monocoque glass-fibre/resin body. Even more impressive was the fact that it had been deliberately driven at 25 m.p.h. against a concrete post. While the photograph (Fig. 3) does not show it clearly, there appeared to be no damage to the structure at the point of collision, which is shown by the white arrow. The surfacing of the body, however, had been poorly executed, for the texture of the glass-fibre was clearly visible beneath the dark blue enamel. Also on this stand was an interesting industrial application, a small stretcher for use in mines made by the Manuver Cie. On the stand of S. A. Sheby of Paris, manufacturers of polyester resins, was seen another interesting industrial application in glass-fibre reinforcement made by its subsidiary company, Société Industrielle de Liants Organiques: a pressure-moulded wheel some 10-11 in. diameter and 2½ in. thick for use on printing rollers. Several stands showed practically, how the liquid resins are applied.

The general exhibits of raw materials followed the usual forms but the well-known firm of Péchiney who have been foremost in the production of p.v.c. and synthetic rubbers are now in process of manufacturing a new chlorine-fluorine polymer, polytrichlorfluorethylene which may be termed a "halfway house" to p.t.f.e. It is stable up to 200° C., and permits of easier moulding than p.t.f.e. Samples were not available at the time, but further details have been promised. At the stand of Monsanto-Boussois, the Franco-American company with works at Wingles in Pas de Calais, the entire space was devoted to the dry-colouring of Lustrex polystyrene, a process which attracted large crowds throughout the period of the exhibition.

Among foreign exhibitors were companies from Great Britain, the U.S.A., Germany, Italy, Belgium and Switzerland. The B.I.P. Group showed resins, moulding powders, tools and a fine practical exhibit of glueing technique. R. H. Windsor, Ltd., and Foster, Yates and Thom, Ltd., represented the British

Fig. 5.—Melamine moulded cup and saucer with green rim decoration (Plastorex).

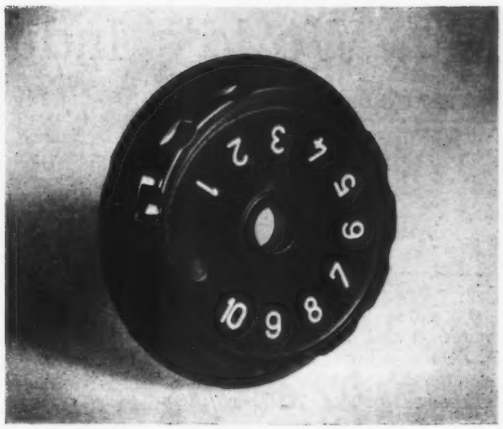


Fig. 6.—Melamine "injected" figures on phenolic knob (Plastorex).

injection, extrusion and compression machine section. Farbewerke Hoechst A.G. showed Hostaflon, polytrifluorochlorethylene, stable up to 200° C., and Dynamit A.G., exhibited polyamide rod from 30 mm. up to 300 mm. diameter.

Among the moulders, the largest stand was that of M.I.O.M. who produce a wide range of components in a variety of plastics materials for the electrical, textile, radio and television, motorcar and refrigerator industry. This company has also experimented widely in glass-fibre structures.

One of the reasons for my visit was to see the work of Plastorex, a moulding company with works in Annecy. I was interested because Mr. T. G. Brook-Hitching, managing director of Ranton and Co., Ltd., who specialize in melamine table-ware, had shown me an attractive melamine cup and saucer made by Plastorex which bore the decoration shown in Fig. 5. The decoration (it can scarcely be called a design) consists of green rims on otherwise simple white. This may not sound much but the total effect was startling and at once brought the ware right out of the normal. Obviously the process of "laying on" the coloured rims must have been exceptionally difficult. Mr. Guy, director of Plastorex, also showed me an unusual moulding (Fig. 6), in which numbers in white melamine have been moulded into a phenolic knob—an immense improvement on the normal process of "filling in" with pigmented wax.

Polythene and p.v.c. bottle manufacture is fairly extensively carried out. Among the exhibitors in this field were Uniplax and Plasverre, the latter making blown polythene bottles up to 30 litres (6½ gallons) capacity for acid transport.

Probably the largest fabricator from sheet is Jumo S.A., who carry productions for the refrigeration, lighting and publicity fields. Vacuum forming has been employed for a number of years. A good example was seen in a refrigerator body of 200 litres (44 gallons capacity), 1.3 in. by 0.6 in. by 0.35 in. in size. On this stand were also seen large polymethylmethacrylate tubes and armoured "acrylic" and p.v.c. sheet for glazing and ceilings.

Machinery

The plastics industry in France has always had a strong body of engineering companies behind it and although the large injection machine (e.g. over 8 oz.) is, so far as we know, a rarity, this section has kept up with the times in many ways. Of the extruders an interesting type, the 4 screw Jumex, was shown on the stand of S.A. Duplex of Ferriere-la-Grande (Nord), who also specialize in injection machines up to 8 oz. capacity. The extruder (Fig. 4) is seen here fitted with a film producing attachment—and was employed at the exhibition making continuous rolls of polythene film. Trudex (France), Ltd., an associate of the Swiss Company, showed their extrusion machines producing 3-in. polythene piping on the stand.

The machine that drew most attention was the new Formvac Model G., a fully automatic vacuum forming machine made by Hydro Chemie of Zurich and seen on the stand of the French agents, Laroche. An earlier type was described in this journal (Mar, 1954, p. 99/101), but the machine on the stand was a twin type, the two stations being capable of producing different fabrications although timing is such that both use the same source of heat. The machine is exceptional because of the large size of finished products (up to 48 in. by 72 in.) that can be obtained, the temperature control and preadjustable cooling cycle, the so-called drape process and the "button-press" production. The "drape process" is achieved by moving the mould upwards into the heated sheet when the vacuum is actuated, "draping" the sheet round the mould. The value of the expression "draping" which theoretically would result in absence of stretching and therefore in retention of original thickness and much elimination of waste, depends obviously on the extent to which the mould rises into the sheet which is held in the frame. While it may therefore be regarded as somewhat exaggerated there is no doubt that the machine is a considerable advance on most vacuum forming machines. I saw several results of great interest from it—a child's bath, an experimental stepped pyramid and a "bell," the two last named being of depth greater than the width of base.

M.D.C.

(To be continued)

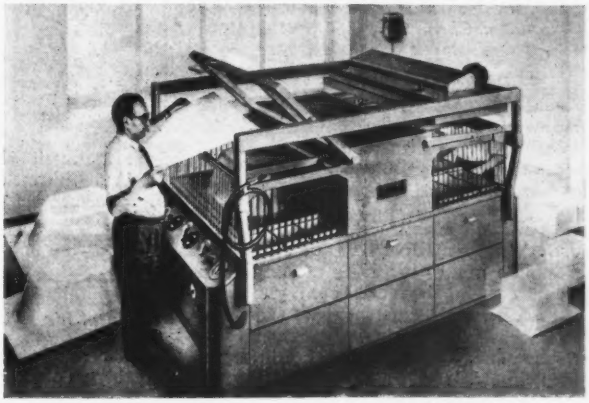
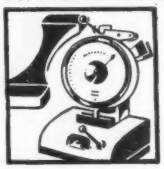


Fig. 7.—Formvac, Model G. (Hydro Chemie).

World's Industry Employs Plastics

MATERIALS and TESTING



Transitions in polytetrafluoroethylene. — In a study of the effect of pressure on high polymers it was found that this material consists of three polymorphic forms within 10° to 80° C., at pressures between 1 and 10,000 atmospheres. Two different transitions may occur at room temperature, depending on the pressure applied.
(*Instrument Practice*, 1954/Nov./986.)

New developments in silicones.—T. A. Kauppi discusses new forms of silicone rubbers, foams, laminate dielectrics, protective coating and oils and greases.
(*Machine Design*, 1954/Sept./176.)

Plastic laminates.—N. A. Skow reported on tests on electrical insulating properties determining the endurance limits of dielectric strength in relation to the lamination.
(*Machine Design*, 1954/Sept./217.)

Styrene plastics.—A materials data sheet is provided for physical, mechanical, electrical and fabricating properties of polystyrenes and modified styrenes for various purposes.
(*Materials and Methods*, 1954/Sept./143.)

Unsaturated polyester resins.—H. Weisbarth and E. Behnke deal with the main factors in processing unsaturated polyester resins. Discussions of the methods of cold and hot curing, importance of suitable mould materials, catalysts, strengthening elements, fillers and pigments.
(*Kunststoffe*, 1954/Oct./447.)

Polymeric plasticizers.—Monomeric ester plasticizers cannot satisfy all demands and interest is shown in higher molecular polyesters of saturated bifunctional fatty acids with glycols.
(*Kunststoffe*, 1954/Oct./429.)

Pile irradiation of polyethylene.—Films and granules were irradiated in heavy water pile, both in vacuum and in presence of air. Composition of evolved gas, stress-strain relations and tensile strength were determined for one period of irradiation.
(*Journ. Am. Chem. Soc.*, 1954/Sept. 5/4304.)

Creep of thermoplastics.—S. Wintergerst and E. Rückerl try to relate experimental results to present knowledge on the behaviour and structure of high-molecular solids. In this way certain irregularities of creep are explained.
(*Kunststoffe*, 1954/Nov./494.)

Urea and melamine resins.—A German draft standard DIN 7708 on urea and melamine resins moulding materials (in German aminoplast) has been published. It describes eight different types and gives, for each, minimum physical values such as bending strength, impact and notch impact strength, etc. Further, the size of the test samples are prescribed.
(*Kunststoffe*, 1954/Nov./510.)

P.V.C. free from emulsifiers and electrolytes.—W. Klein, in a paper before the German Plastics Conference, 1954, Stuttgart, describes the properties and applications of new polyvinylchloride types of K-values from 55 to 70 which are free from emulsifying and electrolytic agents.
(*Kunststoffe*, 1954/Nov./498.)

Weather ageing of styrene and phenolic plastics.—J. R. Taylor and C. H. Adams developed test data to help the designer in selecting plastics to meet a wide range of climatic conditions. The following weather elements seem to contribute most: ultraviolet radiation, humidity, rain and dust erosion and temperature.
(*Mechanical Engineering*, 1954/Oct./803.)

PROCESSES : MACHINERY

High-frequency preheating.—W. Hasel, in a paper before the German Plastics Conference, Stuttgart, 1954, discusses the preheating of thermosetting moulding materials and the improvements obtained. He gives recommendations for the selection, use and maintenance of high-frequency preheaters, based on long years of practical experience.
(*Kunststoffe*, 1954/Nov./528.)

Turning plastics at high speed.—Use of an antifriction centre is recommended to avoid discoloration of the plastic near the centre mark. A special rotating centre has been developed with two single-row bearings clamped together.
(*Tool Engineer*, 1954/Nov./149.)

Low-pressure moulds by metal spraying.—Method gives low-cost low-pressure moulds. Simply produced moulds of plaster and wood cement obtain a metallic surface which can be polished. Valuable experiences are described.
(*Kunststoffe*, 1954/Oct./473.)

INDUSTRIAL APPLICATIONS

Plastic versus metal tubing.—Polyethylene multitube cable for instruments in aeroplanes will decrease installation time and labour costs. They will provide a more flexible overall installation than can be obtained with metal tubing.
(*Instruments and Automation*, 1954/Oct./1614.)

Reinforced plastic tanks.—For improving corrosion resistance epoxy resins have been used instead of polyester resins.
(*Chemical Week*, 1954/July 17/40.)

Fluorocarbon-filled bearings.—Four different types of filled Teflon bearing materials have been developed, making use of the low coefficient of friction and having improved wear resistance. Equipment for testing friction and wear is described.
(*Materials and Methods*, 1954/Oct./112.)

Sintered nylon plastics.—Sintering method extends applications of nylon for intermittent service or where lubrication is difficult and load and speed characteristics are low. Comparison with powdered metals and injection moulded nylon.
(*Product Engineering*, 1954/Nov./150.)

Extruded polyethylene rods.—Solid rods 6 in. in diameter and 7 ft. long have been produced, said to be non-porous and free of voids.
(*Materials and Methods*, 1954/Oct./160.)

Non-metallic gaskets.—An American magazine gives a practical guide to current design techniques in setting up gasket requirements, selecting the right material (including plastics and plastics compositions), specifications and testing procedures.
(*Machine Design*, 1954/Nov./157.)

MISCELLANEOUS USES

Glass fibre reinforced plastics.—W. Beyer gives a general survey dealing with basic raw materials for resin binder and glass fibre carrier, properties and technology. The basic intention is to remove misunderstandings and confusions.
(*Kunststoffe*, 1954/Oct./413.)

Spinnable glass fibres as reinforcement for plastics.—F. Brockmöller describes the various types of fibres suitable for plastics and gives recommendations for the selection of fibres under consideration of processing and final use. He deals also with glass staple fibres and spun staple yarn as reinforcing fillers. Hints are given on the manufacture of pre-impregnated, stable glass fibre mats and fabrics.
(*Kunststoffe*, 1954/Oct./425.)

Moulding of polyester resins.—L. Goerden gives practical experiences on the manufacture and bonding of pre-forms. It is shown that, for optimum results, a certain "know-how" is of importance.
(*Kunststoffe*, 1954/Oct./437.)

Applications of glass fibres materials.—F. K. Trietsch gives a technical survey of glass fibres materials and their applications. Besides production methods, the strength characteristics are discussed.
(*Konstruktion*, 1954/Nov./432.)

Nylon tumbling media.—Moulded nylon double cones are recommended in deburring and polishing fragile parts, such as small parts from zinc, brass or aluminium, jewellery parts, etc.
(*Canadian Machinery*, 1954/Oct./191.)

Design of welded constructions.—P. Voigt summarizes the design requirements for welded plastic constructions and differentiates between mechanical, technological, physical and chemical properties.
(*Industrie-Anzeiger*, 1954/Nov. 9/1395.)

Scrapbook for 1954

A review of some of the highlights of a record year for Britain's plastics industry.

WHATEVER the future may hold, 1954 will always be remembered by the plastics industry as a year of high achievement, coming as it did after a period of considerable difficulty. In every field the industry set new records. This scrapbook recalls some of the highlights of the year. With the limited space available it is impossible to embrace every company which played its part but we hope that the industry will take satisfaction in turning these pages and that it will be given new heart, if this is needed, to do even better in the year ahead.

Dr. Yarsley, in his presidential address at the Annual General Meeting of the Plastics Institute last year, took as his theme, "The Past is But the Prelude." He reviewed the beginnings of our industry and noted the major steps forward that have taken place since the introduction of celluloid in the 1870s. The growth that followed the work of Parkes and Hyatt has not been easy, nor has progress been as rapid as many would have wished for this comparatively new industry. Apart from the complex chemical engineering problems that have had to be solved with the introduction of each new material, the industry's customers, the buying public, have alternated between high enthusiasm and deep pessimism in their view of the industry. Plastics have been variously known as wonder materials and cheap and shoddy substitutes and the path of the company director has not been easy in setting a steady course between these two extremes to preserve investors' confidence in what was bound, one day, to be one of Britain's big industries.

As we look back on the past, at the beginning of this new year, we can remember with nostalgic affection the early days of moulding in the 1920s; we can also remember, but not with the same pleasure, the mistakes that have been made. Misapplications of plastics, both inside and outside the industry, probably did more than anything else to bring the industry into disrepute. The same criticism may be made of all industries in their early state of development.

Today, although we know from the figures available that 1954 has been a record year for production and for exports, the most hopeful sign which we can take with us into the future is the ever-growing awareness by the industry of the importance of using the right materials for the right job. The moulder and fabricator now has at his disposal a wider range of materials than ever before. Within reason, he can find a material to suit almost every application, and we hope that the pages which follow will provide ample proof that, as never before, the industry is making every endeavour to see that plastics materials are put to proper use.

In 1925, the raw materials section of the industry produced 10,000 tons of plastics. In 1954 the industry reached for the first time 200,000 tons. Exports for the first 10 months amounted to nearly £17m., nearly £1m. more in value than for the whole of 1953. These figures do not include manufactured articles and components but are restricted to moulding compounds, resins, sheet, tube, rod and foil. The invisible exports of plastics, to be found in every radio set, electrical articles and motor cars, must also represent a significant proportion of the industry's overall turnover.

We, on the editorial staff of *Plastics*, knew long before the end of 1954 that the year showed promise of unparalleled prosperity for the industry. In May we published a combined Export and B.I.F. issue, the preparation of which involved direct contact with over 500 companies within the industry. The replies, which were carefully analysed and formed the basis of that issue, showed the greatest optimism.

This last year has also seen major developments in the field of raw material manufacture. The production of p.v.c. will be doubled in a year's time as a result of decisions taken in 1954 to build new polymer plants. The industry has received more attention in the financial Press than ever before and the multitudinous comment has always been favourable. This itself marks a revolutionary approach since the City has always been cautious of this comparatively unknown world of synthetics.

The following six pages review the progress in the three sections, raw materials, plant and equipment, and manufactured products. In each one we have selected from the pages of *Plastics* for 1954 a few of the developments that have made news. They serve as a brief review in which the industry itself can take pride and are a fitting record of the most prosperous year the plastics industry has ever known.

From the President

BOARD OF TRADE,
HORSE GUARDS AVENUE,
WHITEHALL, S.W.1.

I am pleased to have a chance to write an introductory note to this special number of "Plastics" because it serves the double purpose of focussing our attention on the achievements and importance of the plastics industry, and of stimulating the industry to renewed efforts. Our daily life, indeed, is full of examples of our dependence on plastics, domestically and industrially; and we know that the industry is always trying to improve still further the quality of its products, and to develop new materials capable of an even wider range of functions.

We are perhaps most concerned at the moment with the contribution of plastics to our exports, and with future developments in our export markets. In 1953 plastics exports earned us £16,000,000 and while they were slightly below 1953 exports in value, they were slightly above them in volume. This emphasises how well our industry has responded to overseas demands for its products and how earnestly it has met increasing competition.

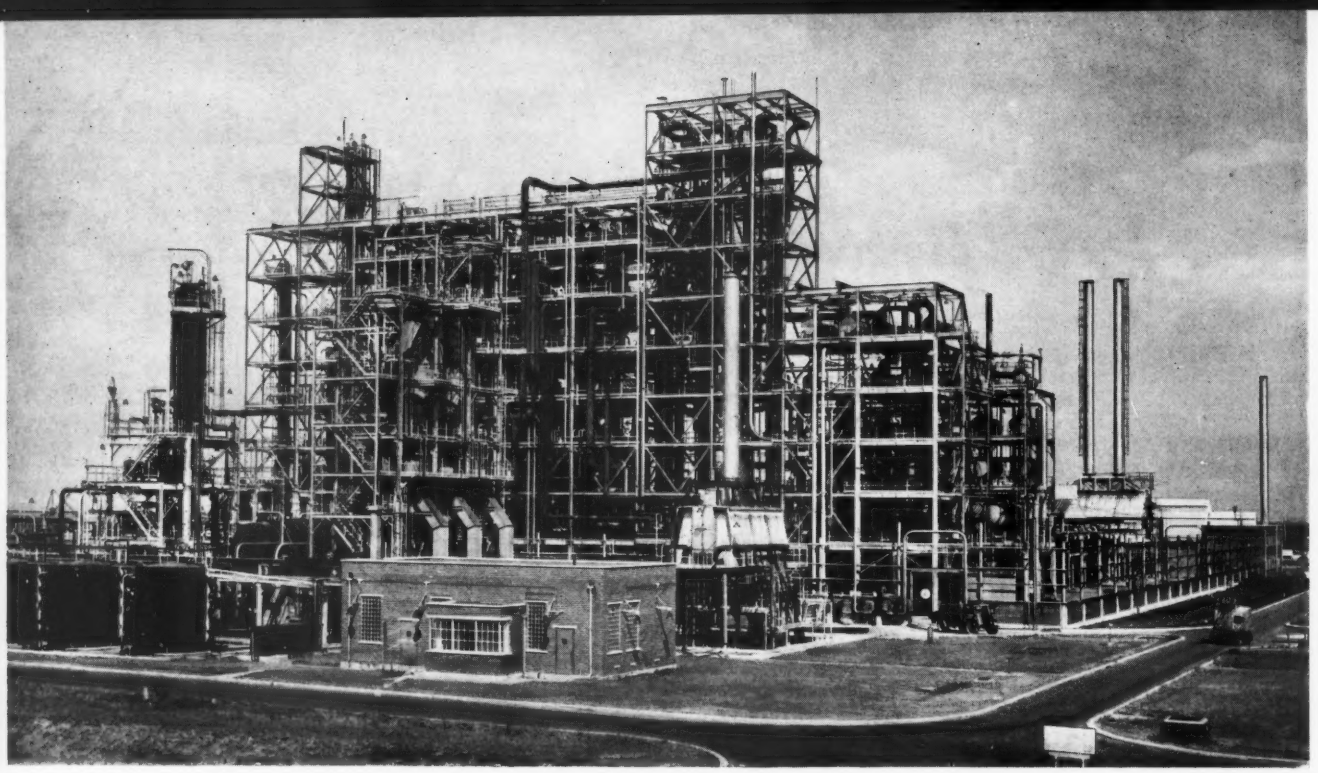
The standard set for the industry is a high one, and, praiseworthy as the work of the last year has been, there is no room for complacency. Fortunately, this is a vigorous industry, conscious of its increasing importance and determined to meet the demands made on it by an era of enormous technical advances. I am sure that the energy and intelligence which produced the successes of 1953 will be applied in equal measure to the tasks of 1954.

14th April, 1954.

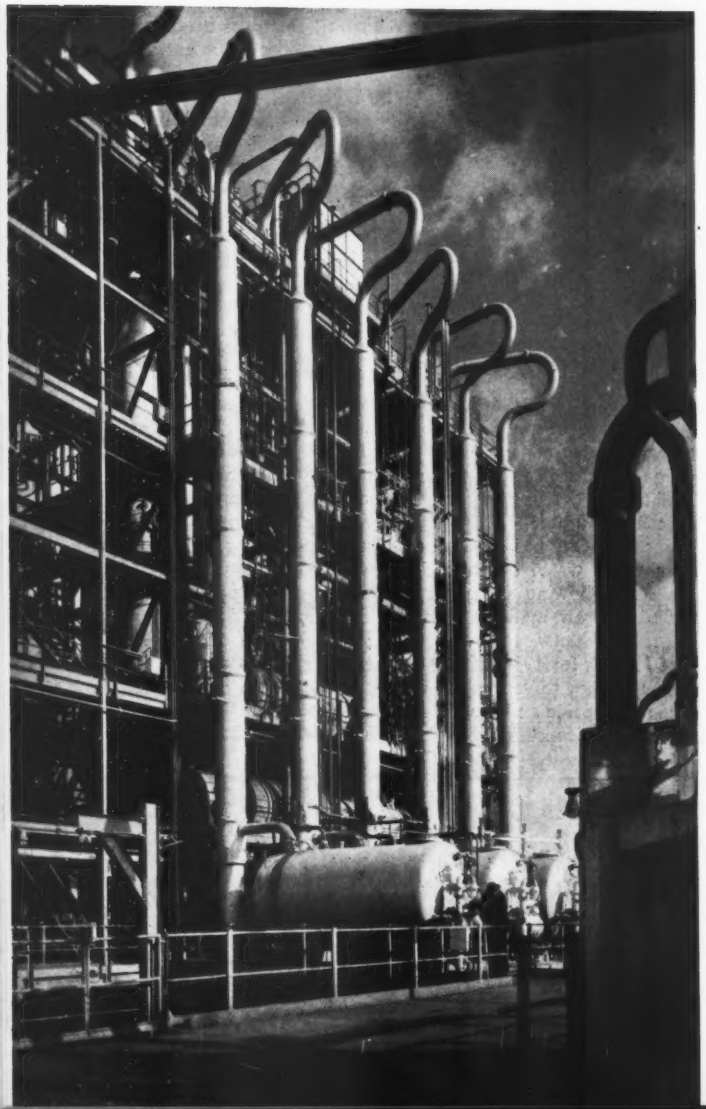
Facsimile of the letter from the President of the Board of Trade which introduced the Export number of *Plastics* in May.

PLASTICS MATERIALS PRODUCTION IN 1954: 200,000 TONS

VALUE OF DIRECT PLASTICS MATERIALS EXPORTS: £17,500,000



Progress in Materials Manufacture in 1954



SO far as *Plastics* was concerned 1954 opened with a swing, for we were able to describe the new copolymer plant of Bakelite, Ltd., at Aycliffe, Co. Durham. Although Bakelite is known for its phenolic and urea thermosetting products, the company has, since the early days of the last war, been active in the thermoplastic field. These latter compounds were originally required to make good the rubber deficit due to the Japanese invasion of the rubber-producing countries. Capacity at this plant at the moment is 5,000 tons a year. The main products, the Vybak range of vinyl copolymer resins are widely employed in wire and cable covering, motorcar wing piping, garden hose and in sheet material for handbags, and as side-screens and rear windows for drop-head coupés. Compounds of this type are also much used for injection moulding. More than 500 people are now employed at the Aycliffe works which represents a new addition to our thermoplastics capacity.

In February we recorded the opening of the new laboratories at the Plastics Division of I.C.I., Ltd., at Welwyn Garden City. Amongst the most modern and complete laboratories that have ever been erected in this country, they offer new scope for the team of scientists and technologists who have been responsible for the development of Perspex, polythene,Terylene and other plastics materials. They were opened by Sir Cyril Hinshelwood, Lee Professor of Chemistry at Oxford, supported by Dr. Alexander Fleck, chairman of I.C.I., Ltd.

In April one of the editorials was devoted to the production of rubber-like polymers. An announcement had just been made that I.C.I., Monsanto Chemicals and Dunlop Rubber Co., Ltd., were to produce these new materials in this country. Pilot plant quantities were being made by I.C.I., the full-scale plant being scheduled to go into production in 1956 at an estimated rate of 10,000 tons per year. Monsanto Chemicals completed, in 1954, the construction of a pilot plant and announced an expenditure of £½m. on the development of a large-scale plant designed to produce 4,000 tons per year and to go into production in 1956. Dunlop Rubber Co., Ltd., also set aside £½m. for the manufacture of synthetic rubbers at Fort Dunlop. These developments were of the greatest interest not only because of the vast capital expenditure involved but

Scrapbook for 1954

also because of the fusion of interests between the rubber and plastics industries.

The export situation came up for review in the May issue. I.C.I. were asked to contribute some notes on the export situation for 1953. Under the headings, vinyl products, acrylic products, polythene products (excluding tube and film), the company exported in 1953 material to the value of nearly £7m. I.C.I. expected 1954 to show a steady expansion. These figures speak for themselves since they indicate very clearly the health and vigour of the raw materials industry.

Although the emphasis in this past year has been on thermoplastic materials, the thermosetting compounds have played a great part in the industry's prosperity. The July issue contained a review of the progress of British Industrial Plastics, Ltd., well known for their wide range of urea resins. The year 1925 marked a highlight in the company's progress when the first urea moulding powder was shown at the Wembley exhibition. Today, apart from the numerous range of resins based on urea which are manufactured for a wide variety of purposes, the company is also intimately concerned with the manufacture of melamine compounds. Apart from special technical applications, melamine moulding powder holds great promise in the tableware field.

The editorial in September discussed the influence of molecular weight upon polythene. I.C.I. had previously announced the expansion of their plant at Wilton which is scheduled to take place within the next two years, bringing polythene production in this country up to 35,000 tons a year.

Silicone compounds reached the front rank of importance 12 years ago; they have been found to be of the greatest use in the electrical industry where they offer high temperature resistance, in the aircraft industry where they are widely used as "rubber," for hot-air ducts and as parting agents, gaskets, backings and lubricants. In November we described the new plant of Albright and Wilson, Ltd., at Barry, South Wales, one of the most up-to-date chemical engineering systems in the world.

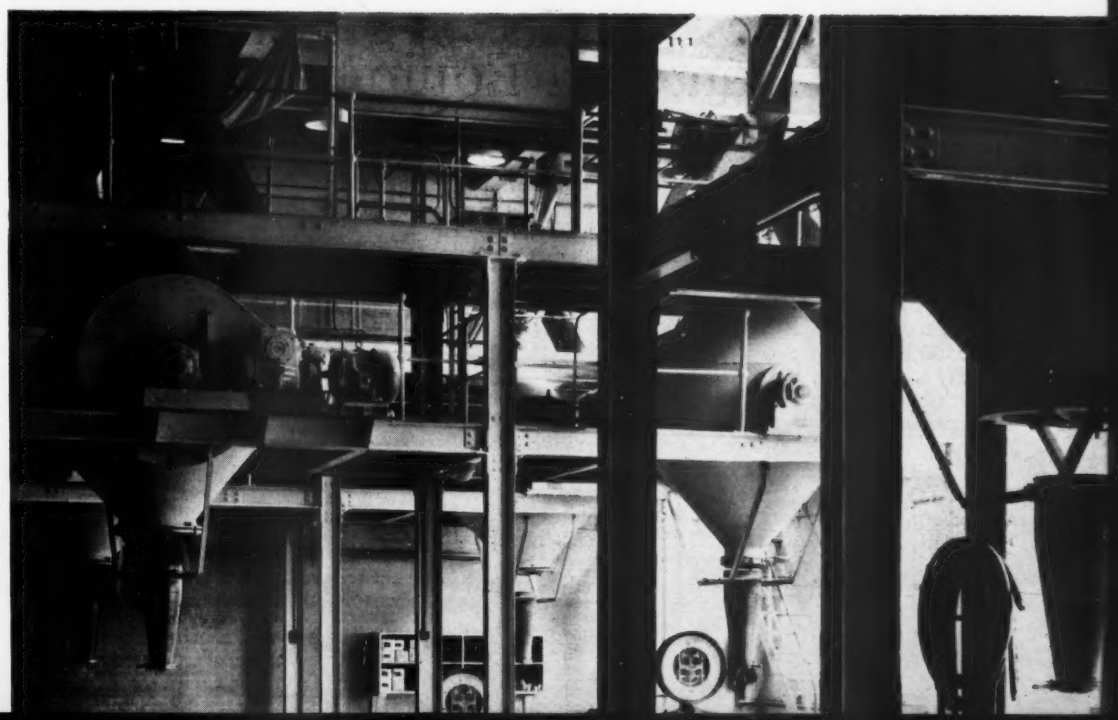
Towards the end of the year came news of the near-completion of the Shell epoxy resin plant at Stanlow.

The editorial in the December issue described the record of production for the year. In terms of tons, production has risen somewhat as follows, 1925, 10,000; 1938, 30,000; 1942, 40,000; 1946, 80,000; 1948, 130,000; 1954, 200,000. These figures may well be taken as a fitting conclusion to this brief résumé of the raw materials situation for 1954. They show a marked increase in manufacturing capacity and as such have a very real importance not only to the industry but to those outside who are concerned with the purchase of plastics materials and with finding the money for the construction of new plants. The steady increase in production of these plastics has involved very substantial investment particularly since the majority of the newer thermoplastics can only be manufactured with the aid of the most expensive and complex plants. The fact that the industry has made plans, for the doubling and in some cases the trebling of the manufacture of various plastics materials is evidence enough of the industry's faith in its future prosperity.

FACING PAGE:

(Top) Olefine plant at Wilton site of I.C.I. Ltd.

(Bottom) Silicone plant of Albright and Wilson Ltd., at Barry.



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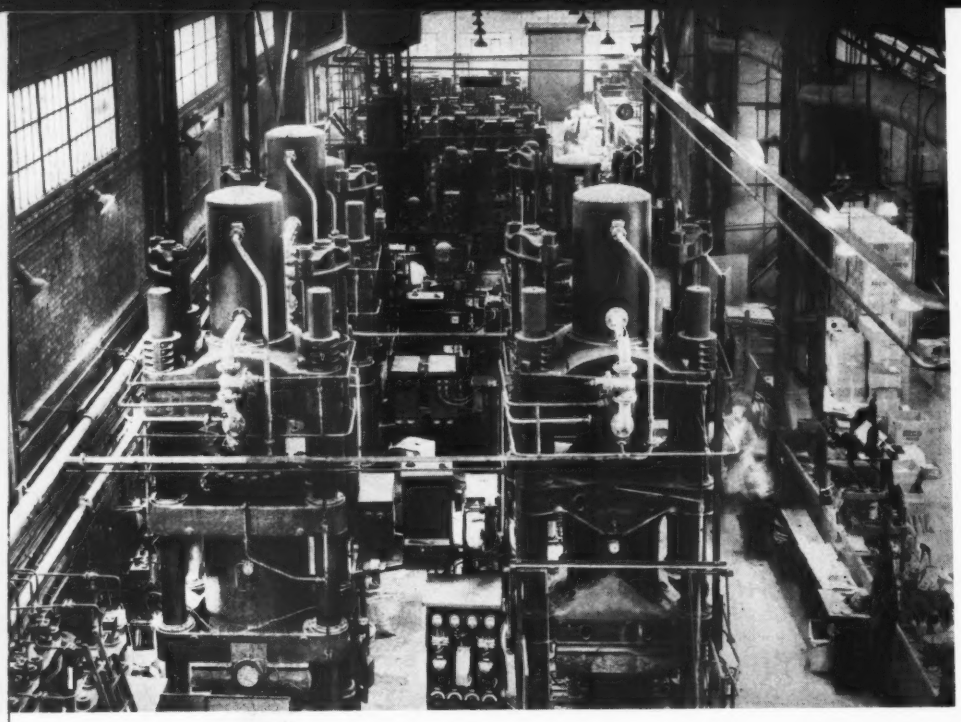
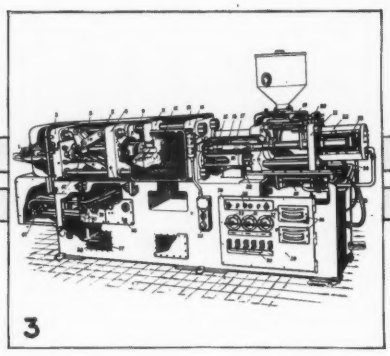
(Top) New Copolymer plant of Bakelite Ltd., at Aycliffe, Co. Durham.

(Bottom) British Industrial Plastics Ltd. A view of the new moulding powder plant at Oldbury.



Scrapbook for 1954

1. View of main thermo-setting moulding shop at the plastics division of E. K. Cole, Ltd.
2. Profile milling in progress at the Witton Moulded Insulation Works of the General Electric Co., Ltd.
3. 4/6 oz. injection moulding machine designed and constructed by the Projectile and Engineering Co., Ltd.
4. New melamine moulding shop at the Brentford factory of Ranton and Co., Ltd. Plant made by B.I.P. Engineering Ltd.



Plant and Equipment in 1954

THE boom of 1954, and there can be no other name for it, has been reflected in the increased purchase by the plastics industry of plant and equipment. Coupled with this, existing plant has been operated at capacity level and the description of the plant at E. K. Cole, Ltd. (January), recorded a tremendous production capacity. A photograph of the compression shop incorporating press capacities ranging from 10 to 2,000 tons is shown in Fig. 1. Although the Ekco Plastics Division moulds considerably for the radio and electronic divisions of the company, nevertheless 85% of its capacity is devoted to outside customers.

Purchase of machine tools throughout the year did not, of course, compare with the vast spending spree that followed the war. The industry's toolmakers have, however, consolidated their position and today there is work in abundance for them. In February two pages of photographs taken by Walter Nurnberg vividly described toolmaking at Witton; a particularly excellent photograph, Fig. 2, shows a profile milling machine at work.

A notable development in the injection moulding field was the introduction of the 4/6 oz. machine manufactured by the Projectile and Engineering Co., Ltd. A detailed drawing (March), appeared in the " Machines for the Industry " series, and showed how rapid has been the development in this field of machine construction. Incorporating a number of novel features, the machine is largely the work of the company's experimental department which has also been working intensely on a new Peco extruder. A miniature replica of the drawing can be seen in Fig. 3.

In the same month (March), a Danish device was described, a preheating unit for use with injection or extrusion machines. This gave rise to great interest since it enabled higher moulding cycles to be carried out and incorporated a magnetic separator to guard against the introduction of trouble-causing metallic particles. Again in the same issue, developments in plant for plastics sheet welding were recorded by E. C. Stanley and H. R. Stilton of Radio Heaters, Ltd. This is a branch of plastics technology which has expanded enormously.

Some indication of the contribution by plant and equipment manufacturers to the export market was contained in the

May issue. Bradley and Turton, Ltd., sold 13 machines in 1949 having a total value of just under £10,000. In 1953, the number of machines had risen to 32, having a value of £27,730.

A noteworthy feature of the June issue was the description of the new melamine press shop at the works of Ranton and Co., Ltd. Equipped throughout with Bipel plant, the shop sets a new standard for efficient moulding and a view is shown in Fig. 4.

Mould making with the aid of low-melting-point alloys was the subject of an article in the July issue. This process, which had been under development for some time, reached in 1954 the stage where it was eminently satisfactory in use for moulds where pressures were not excessive; particularly in the polythene bottle blowing field the results were reported to be excellent. Progress has now been made to enable moulds constructed in this way to be used in the injection moulding field.

In August we had a view of the then incomplete polythene paper coating machine at the Farnborough works of the Telegraph Construction and Maintenance Co., Ltd. The plant, which has now gone into production, is fed by an extruder manufactured by Francis Shaw and Son having an output of polythene of 600 lb. per hour.

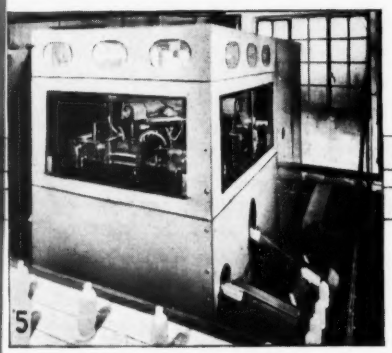
Polythene bottle manufacture achieved new records in 1954, production running at the rate of some 15 million bottles per year. A noteworthy contribution to the bottle making field was the introduction of the Shipton machine, installed at the works of E. Shipton and Co., Ltd., in Middlesex. Fig. 5 shows a close-up of the machine in operation; four separate nozzles are employed for fully automatic operation, the machine illustrated having a 14-oz. shot.

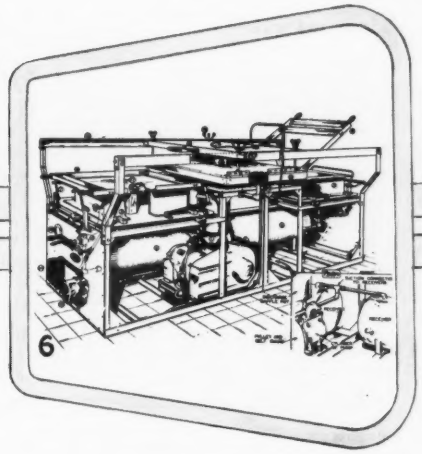
Vacuum forming promoted great interest throughout the year. At least three British companies gave details of machines for this technique and one, manufactured by the Pulsometer Engineering Co., Ltd., was the subject of an exploded drawing in the August issue. The drawing can be seen in Fig. 6.

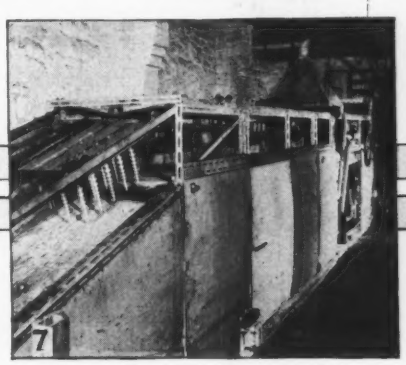
In October came the first news of a new fast moulding press for alkyds. Designed by the E.M.B. Co., Ltd., of West Bromwich, the machine will give cure times with alkyds from 10 to 12 seconds for a moulding ½-in. thick.

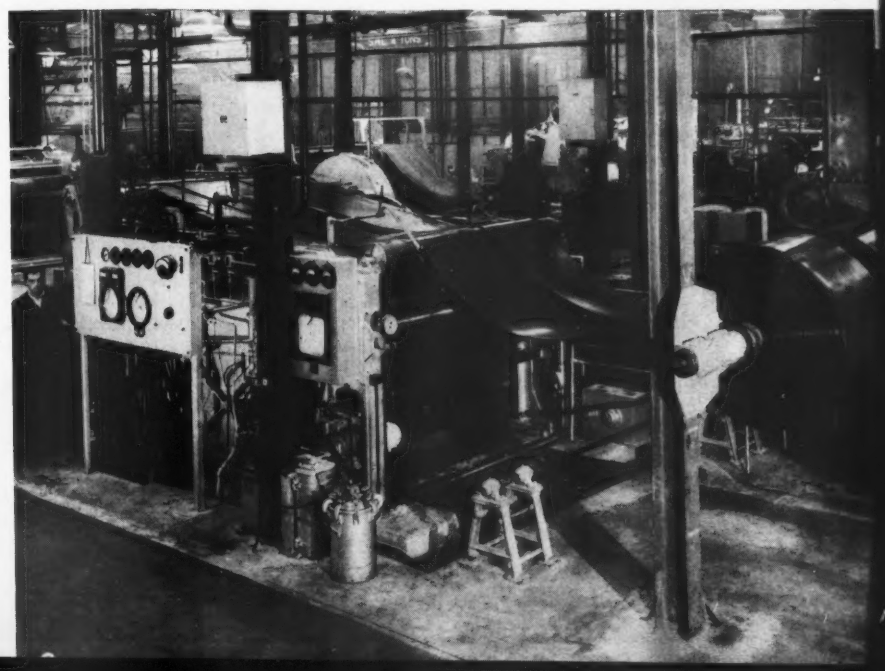
Dip moulding and dip coating are two processes which have grown very rapidly from the years immediately after the war. Durable Plastics, Ltd., of Guildford, have a special machine, shown in Fig. 7 for the rapid moulding of such items as cable connectors, flexible couplings and vacuum cleaner components.

Nineteen-fifty-four concluded with a description of multiply p.v.c. conveyor belting at the works of Rubber Improvement, Ltd. A special feature was the description of the two continuous fusing machines installed in the company's works, a view of one being seen in Fig. 8.

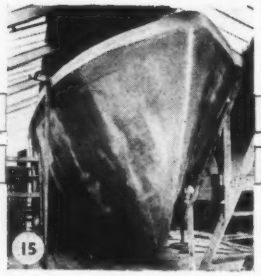


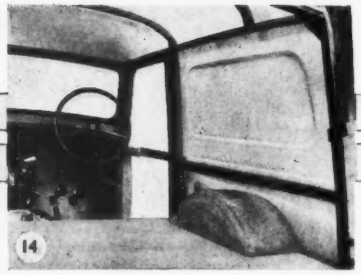


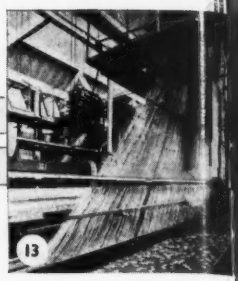




5. Automatic machine for the manufacture of polythene bottles. Using four die heads leading from one extruder barrel, the machine is made by E. Shipton and Co., Ltd.
6. Vacuum forming machine designed and built by the Pulsometer Engineering Co., Ltd.
7. Plant for continuous dip moulding with p.v.c. at the works of Durable Plastics, Ltd.
8. P.v.c. flame-proof belting is made with the aid of this Rotocure machine at the Wellingborough works of Rubber Improvement Ltd. P.v.c. calendered sheet and coated fabric is used in this process.







Progress in Processes and Products in 1954

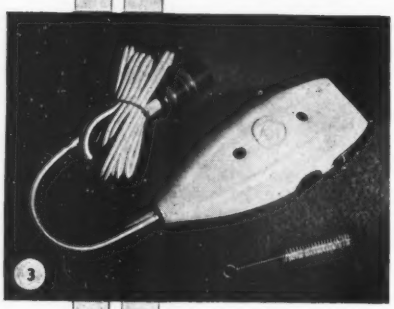
NINETEEN-FIFTY-FOUR saw progress in every branch of plastics fabrication, in some cases very marked, and in others less spectacular but no less important. In the case of the former, these caught the public eye, either in the form of moulded products that they could buy or because they made news for their intrinsic "newness." On these two pages we have attempted to capture some of these items which have made news during 1954, and which at the same time mark significant progress in technology within the plastics industry.

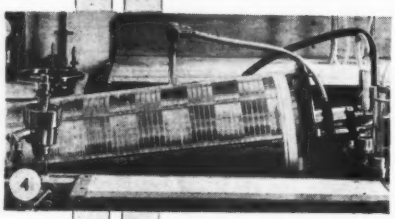
Polythene came right into the public orbit and favour in two separate and clearly defined fields. As a material suitable for the moulding of kitchen equipment the housewife embraced it at once. She frequently took some convincing that it was a "plastic," but the lightness in weight, absence of noise, strength and eye appeal left no doubt in her mind that this was a step forward. The sales of buckets and bowls leapt ahead and one manufacturer ran a half-page advertisement in a national daily newspaper.

In another field, packaging, polythene made tremendous progress. The production of polythene bottles is now running at an estimated figure of 16 million per year. Several companies have played a large part in their development, notably Cascelloid Ltd. and E. Shipton and Co., Ltd. Fig. 1 is taken from an article in the August issue of *Plastics* in which progress in this field was described. The bottle shown, used for cosmetics, was made on the new automatic Shipton machine.

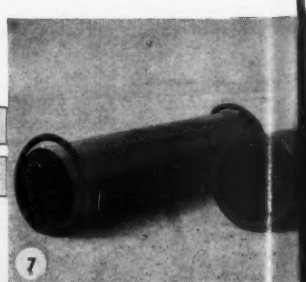
Vacuum forming was the subject of several articles, from the standpoint of plant and technique. A notable development (August) was the printing on p.v.c. and acetate sheet prior to vacuum forming, preserving accuracy of register. The display advertising industry has shown great interest in this development and Fig. 2 shows a typical product, printed in blue and yellow against a white background, fabricated by Cannon Plastics Ltd. and Bas Relief Advertising Ltd. Plastics display signs possess all the advantages of traditional materials, plus resistance to outdoor conditions.

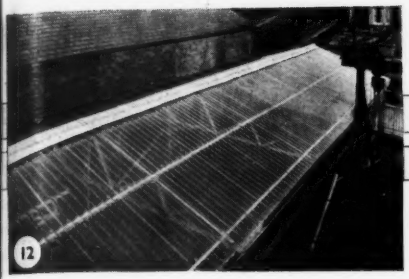
Polystyrene made progress by virtue of the introduction of new impact grades, and a de-staticized variety. Erinoid Ltd. manufactured a medium-high impact compound having improved impact resistance, and this was used by Injection Moulders Ltd. in the manufacture of an electric razor body (September). A high level of industrial design distinguished

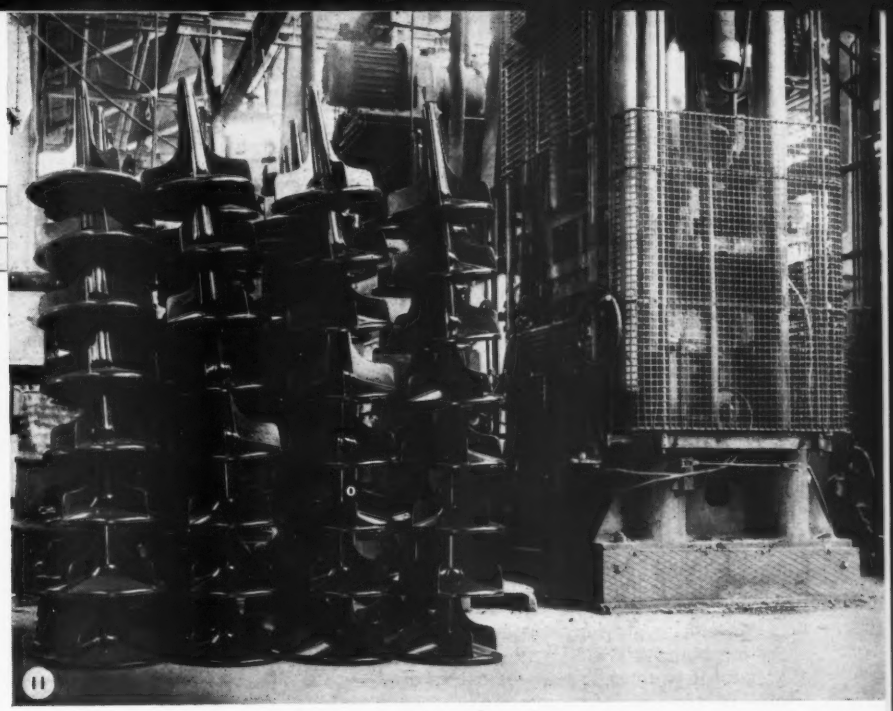




1. Polythene bottle
2. Vacuum formed display sign
3. Injection moulded polystyrene razor housing
4. Perspex and p.t.f.e. uses in surgical apparatus
5. Polythene water piping
6. Perspex for display signs
7. P.v.c. for fume ducting
8. Decorated tableware
9. Dipping p.v.c.
10. Moulded nylon
11. Washing machine impellers.
12. Perspex roof lighting
13. Terylene used in weaving machinery
14. Reinforced plastics used for commercial vehicles
15. 45-ft. boat hull in polyester/glass fibre laminate







Scrapbook for 1954

this moulding and, coupled with the material, offered an elegant and workmanlike application. The razor is shown in Fig. 3.

Plastics steadily gained ground in the medical field, and frequent mention of interesting applications was made in "Talking Shop." A feature article (July) described the use of polymethylmethacrylate, p.t.f.e., and p.v.c. in the construction, at the Postgraduate Medical School at Hammersmith, of a mechanical heart-lung. Built under the guidance of Professor Ian Aird, the machine (Fig. 4) purifies the blood and also exerts a pumping action, so that delicate operations can be carried out where the patient would otherwise be unable to withstand the shock.

Another important plastics application making use of polythene is piping for civil defence and emergency water supply. A news item (June) noted the first large-scale fire-fighting exercise in London using this piping. Extruded in 16-ft. lengths, with a 6-in. bore, each length weighs only 50 lb. An auxiliary fireman can be seen in Fig. 5 carrying a 16-ft. length.

A number of Production Stories were published in 1954, being designed to focus attention on a specific manufacturing technique. One of them (March) described the fabrication of a Shell sign from sheets of Perspex 5 ft. square. Using the low-pressure process, the sign is made by Thermo-Plastics, Ltd., Dunstable, and is shown in Fig. 6.

Both polythene and p.v.c. have been used with great success in chemical plants and laboratories. The large-bore welded tubing (Fig. 7) was fabricated in p.v.c. at the works of Rediweld Ltd. (September).

Although melamine tableware has proved highly successful there can be no doubt that new horizons would be opened up if a simple method of decoration could be found. As an experiment, repeat experiment, we asked a well-known artist (September) to hand paint a selection of melamine and urea mouldings. The effects obtained were most gratifying (Fig. 8) and they were subsequently protected with a transparent synthetic resin coating.

Dip coating, although not a new technique, made considerable progress and was the subject of two articles in *Plastics* (August and September). The latter article described the work of Durable Plastics, Ltd., of Guildford and Fig. 9 shows a number of photographic separator baffles immediately after dipping in the polymer bath.

Nylon achieved distinction by being the subject of an exhibition in London (April). Apart from a very large number of industrial applications which were shown, several domestic uses for nylon were displayed. The mouldings seen in Fig. 10 were carried out by Halex Ltd., and include brushes and combs and a set of coloured beakers.

The work of one of the biggest moulding plants in Europe was the subject for a Production Story in October. The article described the manufacture of a number of components for washing machines at the Wilton Moulded Insulation Works of the G.E.C. and Fig. 11 shows an array of impellers, moulded in phenolic material.

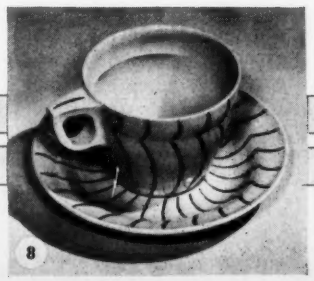
Acrylic roof lighting continued to gain favour, particularly for industrial buildings. An interesting application (April) is shown in Fig. 12; this Perspex roof covers part of the steel stores of T. H. and J. Daniels, Ltd., the plastics machinery manufacturers of Stroud, Gloucestershire.

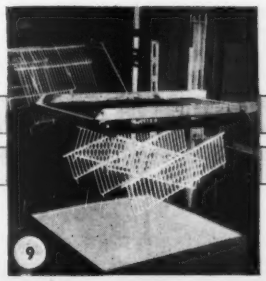
"Fibres from Plastics" was the title of an article in September which reviewed the relationship between the plastics industry and the textile industry. Much of the knowledge we possess today of polymer technology has its origins in the work of the great scientists such as Carothers who were concerned primarily with the manufacture of fibres from synthetic sources. Fig. 13, an illustration used in that article, shows the use of Terylene polyester yarn as Jacquard strings.

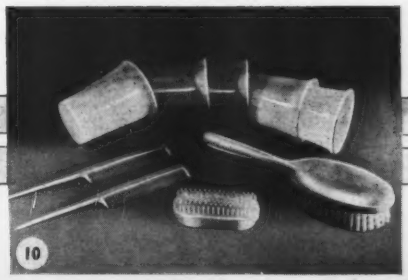
This review of the applications of plastics for 1954 may well be concluded with a note on reinforced plastics.

An article in the September issue described the use of these materials in the construction of the Reliant 5-cwt. van. Here the roof and side panels are entirely of glass fibre, being bonded around wooden frames. This technique, gaining in popularity in the commercial vehicle field, offers considerable economy when used in place of panel-beaten light alloy. Fig. 14 shows an interior view of the Reliant van.

A 45-ft. glass fibre motor boat was launched in August and was described in September. A view prior to launching of this Halmatic craft is shown in Fig. 15.







LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Protection of Data Sheets

SIR,—Several of our European agents use a plastic sheath for protecting data sheets in salesmen's loose leaf binders. This generally comprises an envelope, size approximately 8½ in. by 11 in., made of p.v.c. or similar material, bound on three sides with some sort of plastic binding tape and open on one side or at the bottom for slipping in the printed matter. The sheathes are punched on one side to match the punched holes of the printed matter they protect.

We wish to provide something similar for our home sales staff, and we shall be grateful if you can suggest the names of one or two manufacturers who could meet our requirements.

WOODS OF COLCHESTER, LTD.
Colchester,
Essex.

Perforation of Leathercloth

SIR,—We are wondering if you could possibly assist us by letting us know how we could get leathercloth perforated. Can you please say who makes the necessary machinery, or who could carry out such work if we sent the material to them.

BERNARD WARDLE (EVERFLEX), LTD.
Peblig Mill,
Caernarvon,
N. Wales.

Trade Name

SIR,—Could you supply me with the address of "Leithen Valley Plastic Products" who manufacture Perspex trays, covers, etc., for the catering trade.

A.R.

Plastics Tapes

SIR,—We have received two inquiries for plastics binding tape used for binding the edges of carpets and mats. Can you recommend us manufacturers of such binding tape?

One of these tapes is self-adhesive if ironed on to the carpet.

BRITISH-CONTINENTAL TRADE PRESS, LTD.
222 Strand,
London, W.C.2.

Plastics Light-chains

SIR,—We are requiring plastics jack chain for the suspension of fluorescent lights in our laboratories where metallic chain is affected by fumes and does not last long. Can you put us into touch with probable suppliers?

APLIN AND BARRETT, LTD.
Yeovil,
Somerset.

Door Furniture

SIR,—We understand that it is possible to obtain a white plastics flush pull somewhat similar to a chromium-plated flush pull but slightly larger.

We should be obliged to you if you could let us have the name of any supplier.

GEORGE BARKER AND CO. (LEEDS), LTD.
Elder Road,
Bramley,
Leeds.

Thermoplastic Impregnated Cloth

SIR,—We have read on page 393 of the December issue of *Plastics* a reference to a thermoplastic impregnated cloth. We believe that this material would be very suitable for our use and we shall be glad if you could let us know from whom this can be obtained.

A. G. THORNTON, LTD.
Wythenshawe,
Manchester

[EDITOR'S NOTE: This refers to Celastic manufactured by Celastic Corporation, Arlington, New Jersey, U.S.A., and is a nitro cellulose coated fabric.]

Nylon Film

SIR,—We should be very grateful indeed if you would bring to the attention of your readers the fact that the Lawfer Chemical Co., Ltd., are joint agents, with us, in respect of Supronyl film, particularly in connection with specific industrial fields of application.

KEMITYPE, LTD.
8 Chase Road,
Park Royal,
London, N.W.10.

Polythene Filter Cloth

SIR,—In the "Letters to the Editor" page of the November, 1954, issue of *Plastics*, a Mr. Sydney Heath asked for the names of polyethylene filter cloth producers.

You may wish to inform him that such material can be obtained from the William W. Stanley Company, Incorporated, 401 Broadway, New York 13, New York State, U.S.A. We have no connection with the above company but are merely trying to be helpful.

MONSANTO CHEMICAL COMPANY.
Plastics Division,
Texas City,
Texas, U.S.A.

Inquiry for Buckets and Tubes

SIR,—On page 386 of the December issue of *Plastics* we saw the reproduction of an advertisement for Neneware. As we are interested in the buckets shown therein we kindly request you to let us know the address of the firm fabricating these buckets.

Secondly we noted on page 410 of the same issue under the heading "Tubes in Plastics" that the Tube Investments, Ltd., have been producing tubes from a new plastic material with a high resistance to heat and total resistance to acids and alkalis. Please be so kind as to give us the address of the company named in order to enable us to contact them.

R. S. STOKVIS AND ZONEN N.V.
Rotterdam,
Holland.

Continuous Fusing Machines for P.V.C.

SIR,—On page 388 of the December, 1954, issue of *Plastics* we have read of a continuous fusing machine under the subheading "Lamination of the Plies." We should be obliged if you could let us know the name and address of the makers of such machines.

TRUBENISED (GT. BRITAIN), LTD.
39 Park Street,
London, W.1.

Phenolic Casting Resins

SIR,—We are very much interested in the article "Tooling with Phenolic Casting Resins for Sheet Metal Pressing," by F. L. Gilbert, in your December issue, and would be grateful if you could put us in touch with the actual manufacturers of these particular resins.

IRISH PLASTIC DEVELOPMENTS.
56 Railway Street,
Dublin, Eire.

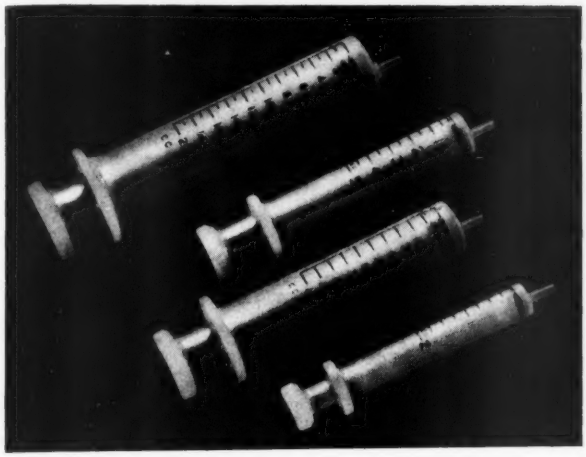
Printing on Polythene

SIR,—We would be very grateful if you could acquaint us with the names and addresses of two or three analysts.

We are experimenting in the printing of treated polythene film and are experiencing certain difficulties with its printability.

WM. HOBBS AND SONS.
43 Lower Stone Street,
Maidstone, Kent.

Developments with the Nylon Syringe



The use of plastics in medical equipment has progressed very considerably in recent years. An outstanding development has been the use of nylon in the manufacture of hypodermic syringes, briefly described in the following article.

SOME years before the first world war we first reported the growing interest of the medical profession in the use of plastics in diagnosis and surgery, an interest that was especially intensified when polymethyl methacrylate, with its optical clarity, ability to transmit light in curves, its toughness, excellent machining properties and ability to withstand sterilization, enabled the construction of instruments to bring cold, safe light of deep-seated operational areas.

The field of application of plastics in surgery and hospital has since widened greatly and now covers not only porothesis replacement of broken or diseased bone structures, the building of complete skeletons, etc., for educational purposes, but also within the structure of the hospital itself. In an environment where the highest standards of hygiene, good lighting and other conditions must be maintained, there is obvious room for the use of plastics. Another reflection of the care which must be taken from the purely safety point of view lies in the accuracy which is essential in the manufacture and installation of what is normally considered simple electrical equipment, such as switches, connectors and cables, for in an atmosphere often charged with ether or alcohol there must be no opportunity for sparking due to faulty equipment or the creation of static charges.

Among the original producers and manufacturers of diagnostic instruments in the first-named field is Vann Brothers, Ltd., who introduced the " Coldlite " series of tongue and throat depressors, operating protoscopes, sigmoidoscopes, and so on, fitted with Perspex elements to enable the worker to direct " cold " concentrated light at any desired point and angle in a manner that 15 years ago was impossible without risk of burning.

New Grade of Nylon Evolved

Progress in this apparently narrow field has been great and has now widened. Among the special products by Vann Brothers, Ltd., in the past year has been the production of the nylon syringe, where high-temperature sterilization and high mechanical strength are exceptionally important requirements in order to replace the purely glass type, which has always been considered a danger. A new grade of nylon, made by I.C.I., Ltd., has been produced specifically for the purpose and has proved, after exhaustive experiments, completely successful for the injection moulding of the Vandermic syringe. The instrument is quite indestructible under ordinary conditions and withstands prolonged sterilization by boiling in water for any period or by autoclaving up to 120° C. Plungers and barrels of each individual size (2 c.c., 5 c.c., 10 c.c., and 20 c.c.) are interchangeable, thus saving time and care in reassembling after sterilization.

The moulding problems of the components themselves were formidable, both from the point of view of the mechanical action itself and from the point of view of interchangeability following sterilization. The high precision results in all the components, nozzle, barrel and plunger, are a credit to the designers and to the injection moulders, British Moulded Plastics, Ltd., and to Punfield and Barstow (Mouldings), Ltd. On a future occasion we hope to publish some detailed notes on this aspect of the matter.

The provision of the volume markings in itself was also a major problem. Moulding by recessed engraving proved unsuitable, for filling of the fine recesses was exceptionally difficult. Both lines and numbers are embossed, so that a simple roller printer can be used. The ink also presented a serious problem; a special type had to be formulated so that it could slightly etch the surface and, indeed " combine " with it. The following is a recent report on the syringe, having an eccentrically placed nozzle, by a Service Department.

Report on the syringe

Capacity	Report treatment	Result
(a) 10 ml. Ecc. nozzle. Hollow plunger.	Boiled distilled water. 2 hours.	Integrity maintained. Markings unaffected.
(b) 10 ml. Ecc. nozzle. Loaded plunger. Double ring.	Boiled in tap water with added alkali.	Integrity maintained. Markings unaffected.
(c) 20 ml. Ecc. nozzle. Loaded plunger.	Immersed in 2% Phenol.	Integrity of syringe maintained. Rubber ring softer and dilated but on drying still capable of efficient use. Markings unaffected.
(d) 10 ml. Ecc. nozzle. Loaded plunger.	Immersed in liquid spirit for 3 hours.	Integrity maintained. Markings unaffected.
(e) 10 ml. Ecc. nozzle. Loaded plunger.	Autoclaved 120° C. 6 hours.	Integrity maintained. Markings unaffected.
(f) 20 ml. Ecc. nozzle. Hollow plunger.	Autoclaved 120° C. 6 hours.	Integrity maintained. Markings unaffected.

The pathologist states that these syringes are an improvement on previous samples, the markings are more legible and the sealing rim of the plunger is of better quality rubber. The tests carried out, although not exhaustive, show that, providing the methods of sterilization and syringe care are those recommended by the makers, the syringes will give long and efficient service.

Production is fast reaching the 200,000 mark, but the whole sphere of application has by no means been covered. Even in the field of normal industry the makers visualize considerable demand among watchmakers and manufacturers of fine small instruments which require precision and deep lubrication of moving parts, where possibility of broken glass must be avoided. We ourselves can see a market also in the plastics industry, where cements, inks and similar fluids are filled in very fine cavities or other apertures.

In conclusion, we beg to thank Mr. C. F. Rapaport, managing director of Vann Brothers, Ltd., whose knowledge of the application of plastics in medical and surgical fields is profound, for supplying us with the foregoing information.

Injection Mould Made with Low-melting Alloys

THE July, 1954, issue of *Plastics* (pages 215, 216) contained a report on a new development, mould making by spraying with low-melting-point alloys. At that time, moulds made by this technique were only suitable for low-pressure techniques such as the blow-moulding of polythene bottles. The process has now been further developed, and the photographs on these pages show the various stages in the manufacture of an injection moulding tool which has proved successful, made from low-melting-point alloys.

A tool was required for the manufacture of spring-clips in polystyrene, to be carried out by S. Smith and Sons (England), Ltd., the alloys being supplied by Mining and Chemical Products Ltd.

Fig. 1 shows the master patterns which were made from aluminium. These were mounted on mild-steel plate which eventually forms one half of a two-piece mould (Fig. 2). The whole assembly was heated to 120° C., prior to being sprayed with Cerrocast, an alloy which has virtually no volume change in solidifying and ageing and which, therefore, produces castings of an extremely high degree of accuracy. This heat treatment is necessary when spraying materials having a good heat conductivity, due to a tendency for the Cerrocast to lift in places with resultant voids. When sprayed against cast resins, for example, no such difficulty is experienced, due to the poor heat conductivity of synthetic materials. The spraying, carried out to a thickness of approximately $\frac{1}{16}$ in. is shown in Fig. 3.

Fig. 4 shows the chase which forms the "frame" of the second half of the tool placed in position and spraying being continued to a depth of $\frac{1}{8}$ to $\frac{1}{4}$ in.

After cooling to room temperature two copper tubes, previously tinned with Cerrocast, were set in position, and

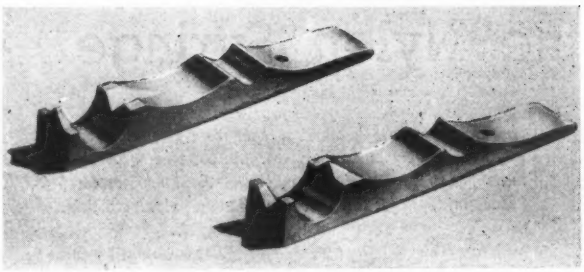


Fig. 1. Master patterns in aluminium.

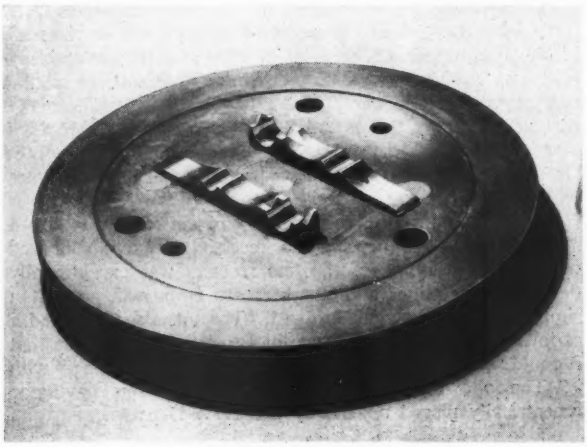


Fig. 2. Patterns mounted in steel plate.

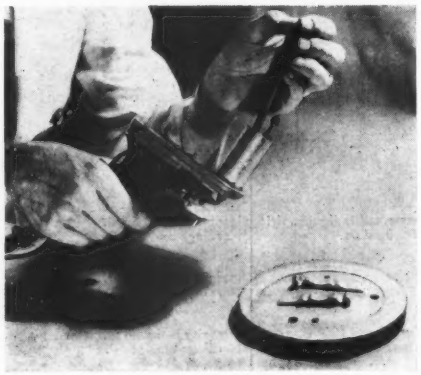


Fig. 3. (Left) Spraying the master patterns.

Fig. 4. (Left) Chase in position which forms the second half of the mould.

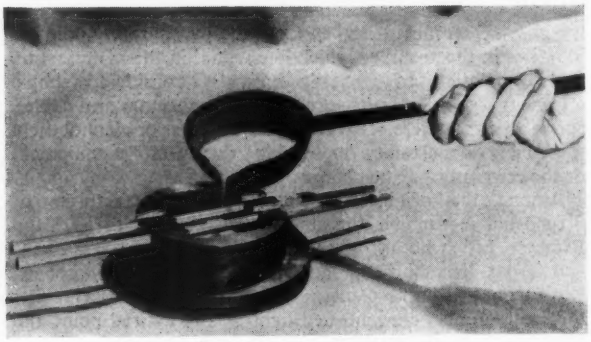


Fig. 5. (Above) Pouring alloy into chase.

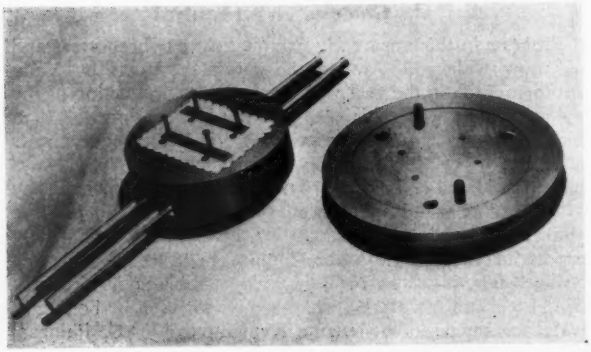


Fig. 6. (Right) Steel plate removed.

Cerrocast was poured in at a temperature of 157° C. At this temperature the tinning on the tubes and the sprayed alloy shell were softened just sufficiently to achieve a good bond. At room temperature and with an $\frac{1}{8}$-in. shell, there is no danger of melting through the shell. This operation can be seen in Fig. 5. In Fig. 6 the mild-steel plate is shown removed.

The master patterns were then extracted, leaving the cavities (Fig 7). Runners and gates into each cavity and ejector pin holes were machined in the alloy and connectors made to the the water tubes (Fig. 8). Inlet sprue and cold well slug were drilled in the mild-steel plate. (A better procedure would have been to incorporate the runners, gates and ejector pin holes in the master pattern. This will be done in future.)

The complete tool was mounted in a vertical injection machine with the water-cooled cavities on the lower platen (Fig. 9). A typical example of a moulded shot is shown in Fig. 10 and a comparison of the moulded item and the master pattern is seen in Fig 11. The assembled final product is seen in Fig. 12.

The injection machine was run at 15,000 p.s.i., cycle 27 seconds at a temperature of 180° C.

The important feature is that water cooling of the cavities enables Cerrocast, which softens at 138° C., to accept material injected at temperatures 40° C. and above, without failure.

An interesting analysis of the time taken to manufacture this tool is given in the following table:—

	Hours
Manufacture of master plate from M.S.	4
Manufacture of chase from M.S.	7
Manufacture of ejector pins and grid from S.S. and M.S.	3½
Manufacture of sprue bush and top plate	6
Spraying and backing	1
Preparation of water-cooling tubes	½
Drilling ejector pin holes and machining runners ...	1½
	23½

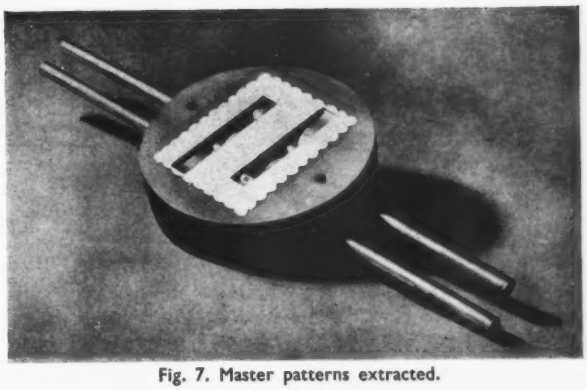


Fig. 7. Master patterns extracted.

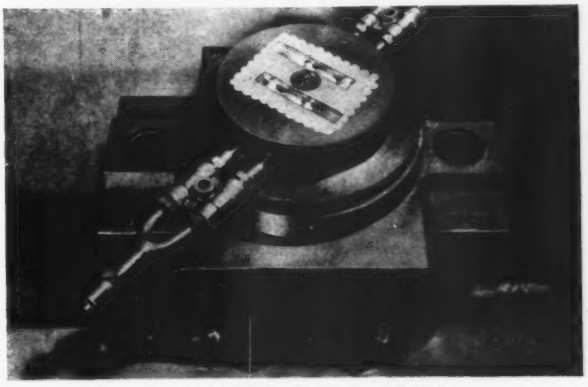


Fig. 8. Runners and gates machined.

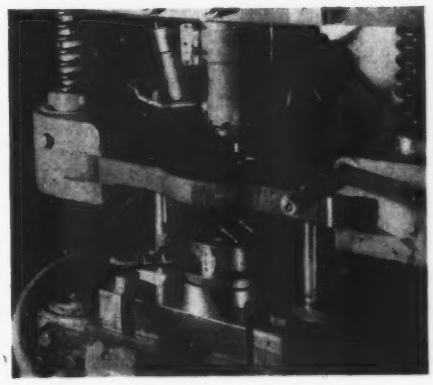


Fig. 9. (Right) Tool installed in injection moulding machine.

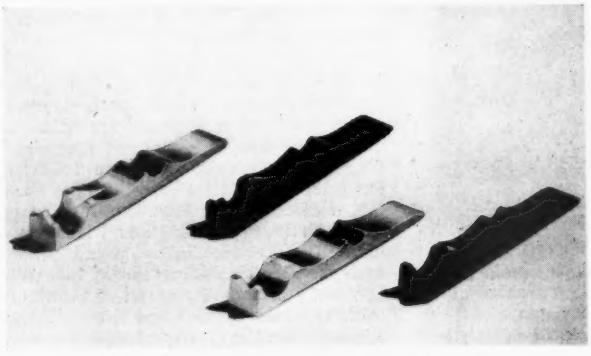


Fig. 11. (Above) Mouldings and patterns compared

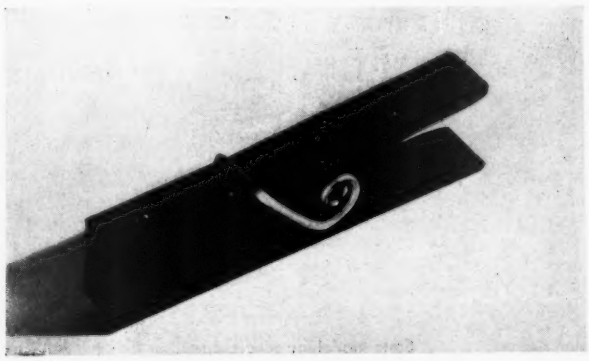


Fig. 10. (Right) A typical shot.

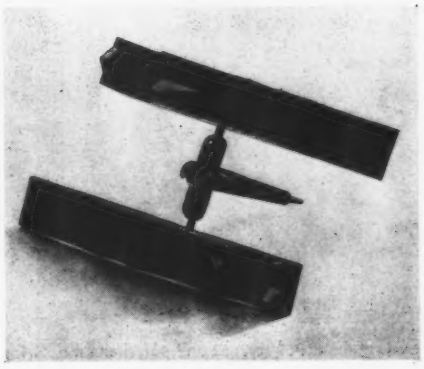


Fig. 12. (Left) The assembled spring clip.

New Productions

(Left) Glass fibre reinforced plastic cafeteria trays.

Polythene Tuboplast container.

Glass Fibre Plastic Trays

A series of trays made principally for cafeteria use from glass fibre reinforced plastics is now being produced by Universal Metal Products, Ltd., Salford, Lancs.

They are manufactured on matched metal moulds from glass roving preforms and can have various surface finishes including patterns of lace, paper decorations or woven fabrics. Advantages claimed are that they can be cleaned in boiling water, they will not chip and are virtually unbreakable, also their design enables easy stacking and packing.

More Plastics Kitchenware

Two measuring jugs, identical in appearance but one being injection moulded in polystyrene, the other in polythene, are the latest additions to the range of kitchenware supplied and manufactured by Stone and Simmons. The graduations are in fluid ounces and proportions of a cup, the actual markings being incorporated in the moulding.

Nylon Bottle

Polythene bottles having become firmly established on the market, manufacturers are now experimenting with other materials in an endeavour to overcome some of the limitations of this material. Our photograph shows one of the first bottles produced in nylon. The advantages in using nylon in this field have hitherto been offset by the difficulties in producing, on a commercial scale, bottles to a set standard. Credit must therefore go to E. Shipton and Co., Ltd., Ferndown, Northwood Hills, Middlesex, for their achievement.

Nylon bottle.

Polythene Tube Container

One of the new developments in plastics packaging which will be on show at the Packaging Exhibition is the range of Tuboplast containers manufactured in polythene by Cascelloid, Ltd. They represent a considerable step forward in manufacturing techniques and should cause considerable interest. Advantages include a considerable saving in weight over glass containers, flexibility and attractive appearance. The tubes can also be printed in up to four colours and can have a round base similar to the type illustrated or have a sealed base similar to the metal foil toothpaste tubes. In the latter application polythene will have an advantage over foil in its resistance to rupture. The cost of these tubes is competitive with that of the conventional foil tube and certain existing machinery can easily be adapted to take the Tuboplast tube.

Plastics Scale Model

The scale model of an M.G. motor car which is used principally for advertising purposes employs five different plastic materials in its construction. These are cellulose acetate, polystyrene, polythene, nylon and phenolics. Meticulous attention to detail has given the model a realistic appearance. It is moulded by Kent Mouldings for Victory Industries (Surrey), Ltd., and has already received much acclaim as an advertising medium. Mention was made in the June issue of *Plastics* of a similar model of a fork-lift truck moulded by the same firm, also for Victory Industries (Surrey), Ltd.

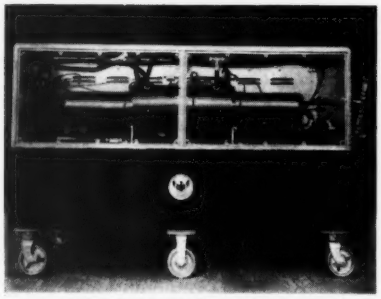
Polystyrene and polythene measuring jugs.

Scale model for advertising

Plastics NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

MOBILE HYDRAULIC INTENSIFIER.—Fawcett Preston and Co., Ltd., of Bromborough, Cheshire, have developed, and are now manufacturing, a portable continuous-acting hydraulic intensifier. The function of the intensifier is more or less orthodox. The L.P. cylinder is in a central position with the two H.P. cylinders one on either side. Low-pressure fluid oil is introduced to the annular area and moves



Intensifier showing L.P. and H.P. cylinders.

the intensifier piston to one side, thus displacing fluid, either water or oil, on the opposite side of the H.P. piston through the H.P. delivery valve to the press cylinder. Suction and delivery valves are fitted in the H.P. intensifier system, connected up by piping to both H.P. cylinders. The contact pressure gauge on the end control panel can be set to any predetermined maximum pressure and when actuated will break the electrical circuit controlling the solenoid of the main L.P. two-way valve, causing it to take up a neutral position. The electrical control gear consists, in essence, of two electrical pressure gauges, one L.P. and one H.P., "Stop" and "Start" push-buttons to operate the L.P. pump motor and a final "Start" button to bring into operation the intensifier unit.

The low-pressure pump is driven by a 10 h.p. electric motor delivering 8 gallons of oil per minute up to a normal pressure of 1,500 p.s.i. When using oil on the output side the intensification ratio is 5½ to 1, i.e., a normal output pressure of 8,250 p.s.i., and when using water the ratio is 4 to 1, i.e., a normal output pressure of 6,000 p.s.i.

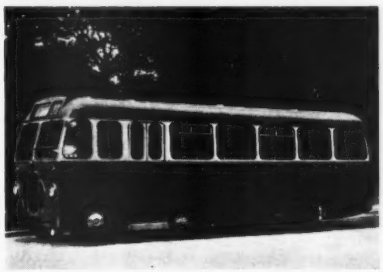
AUTOMATIC MICRO-SIZING.—A push-button method of micro-sizing for centreless grinding machines has been developed by Arthur Scrivener, Ltd., Tyburn Road, Birmingham, 24. It is expected to prove of value where unskilled labour is employed and accurate work is required.

CAMBRIDGE ELECTRONIC RECORDER.—In recent years the improvements in industrial methods and processes have led to a demand for high-grade recorders. This latest model, manufactured by the Cambridge Instrument Co., Ltd., 13 Grosvenor Place, London, S.W.1, is a piece of precision equipment capable of single or multi-point recording. Full details may be obtained from the company.

MEMBRANE FILTER.—A process for the production of membrane filters, which are now available in limited quantities, has been developed by Courtaulds, Ltd. The filters, which are made of cellulose acetate and are approximately .005 in. thick, have a fine porous structure and are supplied in diameters up to 8 cm.

CHANGE OF ADDRESS.—British Insulated Callender's Cables, Ltd., announce that their Bedford depot is closed and a new depot opened at 81 Dumfries Street, Luton, Beds. Mr. W. H. Spillman will be in charge.

NEW BUS USES GLASS-REINFORCED POLYESTER PLASTICS.—Glass-reinforced polyester plastics are being employed in the new 35-seater bus developed by Bristol Tramways and Carriage Co., Ltd., and Eastern Coach Works, Ltd. The components made include front and rear domes, front and corner panels, wing valences, front destination indicator, wheel boxes and luggage racks. The polyester resin is manufactured by British Resin Products, Ltd.



Glass fibre used in bus construction.

PRODUCTION OF TERYLENE IN CANADA.—Pilot plant production of Terylene yarn has commenced in Canada, at Milthaven, Ontario. Full operating capacity is expected to be available next summer and over 11 million pounds of yarn is the estimated yearly output.

PRIME MINISTER'S BIRTHDAY GIFT.—To mark the occasion of the eightieth birthday of Sir Winston Churchill, the Council of the Gauge and Tool Makers' Association have endowed a bed in his name at the Hospital for Sick Children, Gt. Ormond Street.

EXTENSION OF HIGHER ALCOHOLS PLANT.—I.C.I. have decided to expand their plant at Billingham, County Durham, for the manufacture of higher alcohols by the carbonylation process. When the extensions are completed, it will be the largest in the world with a potential capacity of 40,000 tons per year. Among the alcohols made at this plant are Alphanol 79 and Nonanol, both of which are used extensively as the basis for p.v.c. plasticizers.

COMPANY DIVIDEND.—A final dividend of 12% has been declared for Ebonite Container Co., Ltd. The chairman, Mr. W. E. Smith, commented on the increasing costs of material, wages and other overheads, the heavy taxation and also the competition from overseas, which made it prudent to conserve their resources to meet any future eventuality.

PLASTICS INSTITUTE WESTERN SECTION DINNER-DANCE.—The fourth annual dinner-dance was held at the Queen's Hotel, Cheltenham, and was attended by 160 members and guests. The chairman of the Western Section, Mr. A. A. Heath, and Mrs. Heath received the guests. The Loyal Toast was proposed by Mr. Heath and the toast "The Plastics Institute" was proposed by Mr. T. L. Birrell (Past President) and Mr. H. F. Wilson, chairman of the Council replied. Mr. Heath proposed the toast "Our Visitors," to which Mr. J. R. K. Russell (chairman, South Wales and Monmouthshire Section) replied.

REDUCTIONS IN PRICE.—British Industrial Solvents have reduced the price of acetic acid by £3 per ton. Reductions have also been made in the price of n-butyl alcohol and acetates.

Shell Chemicals, Ltd., also announce a reduction in price of £4 per ton on M.I.B.K., Methyl Isobutyl Ketone.

SYNTHETIC-RESIN GLUES IN THE BUILDING TRADE.—Two technical bulletins have been issued by Aero Research, Ltd., covering the use of synthetic-resin glues for the cementing of wooden beams, trusses and other fabricated structural units. Prefabrication, lightness and consequent ease in erection suggest this as an economical method of roof construction.

OIL AND COLOUR CHEMISTS' ASSOCIATION.—The brochures for the Seventh Technical Exhibition, which is to be held on March 15, 16 and 17, at the Royal Horticultural Society's Old Hall, Vincent Square, London, S.W.1, have now been prepared and will be distributed to members of the Association in February. Copies and further information can be obtained from the General Secretary, R. H. Hamblin, M.A., Oil and Colour Chemists' Association, Memorial Hall, Farringdon Street, London, E.C.4.

The conference of the Association will take place at Llandudno from Tuesday, June 7, to Saturday, June 11. The technical sessions and papers presented will come under the general title "Film Structure and Adhesion." Programme details and registration forms for non-members can be obtained from the General Secretary.

NEW BRANCH OFFICES.—Telegraph Construction and Maintenance Co., Ltd., have opened new branches at Gloucester House, 270 Corporation Street, Birmingham; Potters Buildings, Warser Gate, Nottingham; and 16/17 Hills Terrace, Cardiff.

UNIVERSAL METAL PRODUCTS, LTD., advise us that their telephone number has been changed to Pendleton 4444/4449.

LONDON CALLING NEW YORK.—On Friday, November 26, 1954, Her Majesty's Postmaster-General, The Rt. Hon. The Earl De La Warr, opened the new Ocean Works of Submarine Cables, Ltd. This was the first step in the manufacture of the first transatlantic telephone cable, the outcome of many years of research on both sides of the Atlantic into the most suitable materials, type of cable and type of repeaters, or speech amplifiers, to work under water at considerable pressures.

The route chosen for the cable is from Oban, in Scotland, to Clarenville, in Newfoundland, and from there to Nova Scotia, a distance of over 2,280 nautical miles. Two types of repeater are to be used, a rigid two-way amplifier for shallow water and a flexible one-way type. The latter type of repeater will be fitted every 37 miles of the deep-water section, where depths of 2,350 fathoms and corresponding pressures of 3 tons per sq. in. will be experienced. As they are only one-way repeaters, a double cable will be laid in this section. The rigid type of repeater will be used with a single cable in the shorter and comparatively shallow link between Newfoundland and Nova Scotia.

One of the most interesting features of the cable is the use of a polythene base material as the insulant. It is estimated that a quantity in the region of 1,400 tons will be used.

Polythene is not a new material in this field of application; most, if not all, submarine telephone cables nowadays use it as an insulating material. Its low power factor, higher softening temperature, lower water absorption, and numerous other advantages making it superior to gutta-percha, used previously for this work. It is, however, subject to microscopic surface cracking under certain extreme conditions which develop, when it is bent, in an inter-crystalline manner. The tendency towards this environmental cracking becomes less as the molecular weight (and viscosity) of the polythene increases. In order to overcome such tendencies, 5% butyl rubber plus an anti-oxident are mixed with the polythene. This is purely a safety measure, as the conditions causing this environmental cracking are not likely to be found on the ocean bed.

Mixing is completed by extruding and dicing. The cubes or granules are stored in hoppers, where measures are taken to keep the material dry before it is fed pneumatically into the extruders. The central copper conductor, which is formed by wrapping three thin copper tapes around a central solid copper wire, is fed through the crosshead of an American extruder manufactured by Modern Plastics Machinery Corporation. A layer of insulation 0.23 in. in thickness is extruded around the wire, keeping within a tolerance of ±.002 in. From the extruder the cable or "core," as it is now called, is slowly cooled by passing through two long troughs before being finally wound onto large drums, holding approximately 5 miles of cable. The "core" is then examined by a method of manual feeling and the diameter gauged. From here it is stored for 24 hours in temperature-controlled water whilst electrical tests are carried out, each section of cable being subjected to 120 kilovolts. The 5-mile sections are joined in air-conditioned galleries, the joints being tested to 400 kilovolts. The outer conductor, which is a layer of six copper tapes and a binding tape, is wrapped onto the core, forming a co-axial cable. Further testing is carried out before the inner jute serving, the final armouring by compound-covered steel wire, and the outer serving of jute is put on. The completed cable is fed directly into 12 storage tanks, each capable of holding 185 nautical miles of cable, where it is kept under water at constant temperature.

When the cable is working it will provide 36 speech channels, of which 29 will connect New York and London and six Montreal and London. The total cost will be about £12½ million.

Mr. G. W. Hodds

LONG-SERVICE PRESENTATION.—Mr. G. W. Hodds was presented with a gold watch by the chairman and managing director of Bakelite, Ltd., in recognition of his 25 years' service with the company. He joined Bakelite, Ltd., in 1929 as a chemist and in 1951 was appointed to the board.

NEW APPOINTMENTS AT E. K. COLE, LTD.—Two new appointments are announced by E. K. Cole, Ltd. Mr. A. J. Brunker relinquishes his position as general export manager to become chief engineer of the company; Mr. W. M. York, who as an executive director already controls Ekco publicity and the heating division of the company, will, in addition, now direct the export activities covering radio, television, plastics and ciné equipment.

TECHNOLOGICAL COURSES IN PLANT ENGINEERING.—With the increasing mechanization of modern projects, the heavy cost and often complicated nature of new plant and equipment, and the pressing demand for yet higher levels of production efficiency, the status of a plant engineer has become one of increasing importance. Recognizing this fact and its attendant responsibilities, the Plant Engineers' professional institution formulated proposals for examination courses in plant engineering. A scheme of examinations has now been drawn up by the City and Guilds of London Institute Advisory Committee. Details of the syllabus can be obtained from City and Guilds of London Institute, Dept. of Technology, 31 Brechin Place, South Kensington, London, S.W.7, price 6d.

GIFTS AND FANCY GOODS FAIR.—The sixth annual Harrogate Gifts and Fancy Goods Fair is to be held from January 31 to February 4. Further details can be obtained from the Press Officer, 19/25 Gutter Lane, London, E.C.2.

CHANGE OF ADDRESS.—Elliott Brothers (London), Ltd., Bristol's Instrument Co., Ltd., and Fisher Governor Co., Ltd., of Century Works, London, S.E.13, announce the change of address of their Manchester Area Office to 32 Deansgate, Manchester, 3. Telephone numbers: Blackfriars 7752 and Deansgate 6331.

NEW PLASTICS MATERIAL.—A new group of plastics materials are being manufactured by Peterlite Products, Ltd., 24-28 Lombard Street, London, E.C.3. The properties of these materials, which are essentially thermoset-copolymers, are stated as being usually clear transparent and hard, having a high degree of resistance to heat and chemical action. Production so far has been mainly confined to optical work, although the material can be "tailored" to suit different applications.

COURSES IN PLASTICS AT NOTTINGHAM.—Twelve evening lectures have been arranged at Nottingham and district Technical College on "The Application of Plastics in Industry." The series commenced on January 7 and lectures will be held each Friday. Further details can be obtained from the college at Shakespeare Street, Nottingham.

SHORT COURSE OF LECTURES.—Commencing on January 20, The National College of Rubber Technology are holding a short course of five lectures on "Analytical Procedure with Special Reference to Plastic Materials." Details and enrolment forms can be obtained from the college, Holloway Road, London, N.7.

BRITISH INDUSTRIAL PLASTICS, LTD.—As from January 1 the manufacture and sale of moulding powder, synthetic resins and other plastic raw materials at present carried out by British Industrial Plastics, Ltd., at its factories at Oldbury will be transferred to a wholly owned subsidiary company, B.I.P. Chemicals, Ltd. The address will still be Popes Lane, Oldbury, near Birmingham.

NON-MIGRATORY PLASTICIZERS.—Diolpate and Diolpate 195, a polypropylene adipate and an alkylated polypropylene adipate respectively, are described in two booklets issued by R. W. Greeff and Co., Ltd., 12 Finsbury Circus, London, E.C.2. These plasticizers are used in p.v.c. synthetic rubbers, polyvinyl acetate, cellulose nitrate and ethyl cellulose. They are reported to have a very low volatility and great resistance to extraction by oils and solvents in addition to their non-migratory characteristics.

MR. D. G. KAVANAGH, who recently resigned from Monsanto Plastics, Ltd., is now operating as a manufacturers' agent and consultant in the thermoplastic field. His address is 152 Westway, London, S.W.20.

NEW TYPE OF ALKATHENE GRANULE.—I.C.I. Plastics Division are introducing a new form of Alkathene granule. The new product takes the form of uniform spheroids, ⅛ in. diameter, and is formed by cutting extruded laces of polythene while still molten. Advantages claimed are, superior surface finish to extruded articles, higher output from extruders and injection moulding machines, and freedom from blockage.

CELLULOSE FILM LEAFLET.—Transparent Paper, Ltd., have issued a leaflet dealing with the properties and uses of Diophane cellulose film. Copies can be obtained from Halifax House, 51/55 Strand, London, W.C.2.

GLASS FIBRE SHEET AND LAMINATES.—Rubber Improvement, Ltd., are now manufacturing corrugated glass fibre sheet and glass fibre laminates under the trade names of Rilite and Rilglaze.

Presenting the Beetle Trophy.

COCKTAIL PARTY.—Mr. Charles H. Glassey, managing director of British Industrial Plastics, Ltd., is seen above presenting the Beetle Trophy to Mr. E. F. Bayden, winner for 1954. In the middle is Mr. S. A. Goode, Streetly Manufacturing Co., Ltd. The presentation party was held at the Empress Club, London, W.1, for members of the Plastics Industry Golfing Society.

ELECTRICAL ENGINEERS EXHIBITION.—This exhibition, which is to be held from March 15 to 19, will cover an area of 250,000 sq. ft. at Earls Court. This is over three times the area of the 1953 exhibition. The exhibition will not be open to the general public but tickets and further information can be obtained from the General Manager, P. A. Thorogood, M.A.S.E.E., Electrical Engineers (A.S.E.E.) Exhibition, Ltd., 23 Bloomsbury Square, London, W.C.1.

EXPANSION OF THE COMMERCIAL PLASTICS' GROUP.—The Commercial Plastics' Group have acquired additional space by taking over a new factory on the West Chirton Industrial Estate, North Shields.

IMPACT ADHESIVE FOR USE WITH LAMINATES.—Thomas De La Rue and Co., Ltd., are marketing a new household impact adhesive for fixing their Formica panels to existing surfaces.

DECORATIVE LAMINATES.—In the December issue of *Design*, Mr. Paul Reilly discussed the future for decorative plastic laminates. He applauds the modern and adventurous trend in designs and is of the opinion that these materials provide a fine medium for new ideas in decoration.

MR. D. SULLIVAN has joined Melwood Thermoplastics, Ltd., in the capacity of commercial executive.

INJECTION MOULDING OF NYLON.—A booklet just published gives details of the moulding technique which is recommended for use with nylon. It has been prepared by the plastics department of the Algemene Kunstzijde unie N.V., Arnhem, Holland, in connection with the moulding of Akulon. The sole selling agents for the U.K. of this material are Hercules Powder Co., Ltd.

CHANGE OF TELEPHONE NUMBER.—The telephone number of British Cellophane, Ltd., is now Mayfair 7611.

B.I.P. CHEMICALS, LTD.—The directors of the newly formed B.I.P. Chemicals, Ltd., are Mr. C. H. Glassey, chairman and managing director, Mr. C. S. Dingley, Dr. W. Blakey, Mr. J. W. Carr, Mr. W. H. Swallow, Mr. F. C. Rowsell, Mr. P. Russell, Mr. S. M. Clarke, and Mr. S. Whyte.

PLASTICS IN SHOE MANUFACTURE.—Arlington Plastics Development, Ltd., draws attention to the remarkable increase in the use of p.v.c. for shoes in a pamphlet they have issued. This increase has occurred within the past four years and has provided a profitable field for manufacturers of p.v.c. leather-cloth and sheeting.

GLASS FIBRE PLASTICS.—Glass fibre reinforced sheet and tubing manufactured under the trade name of Glascorein is now being made by Thermo-plastics, Ltd., Dunstable. Several grades of material are available and both polyester and epoxy type resins are being used.

LONG SERVICE RECOGNITION.—At a ceremony held at Cefn Mawr, N. Wales, 146 employees of Monsanto Chemicals, Ltd., who had served for 25 or more years with the company, received awards in recognition of that service.

The presentations were made by Mr. P. A. Singleton, managing director, in the presence of the board of directors, representatives of local authorities and nearly 300 relatives and friends of long service employees.

MR. T. E. LAING has been appointed a director of British Resin Products, Ltd. Mr. Laing was general works manager of the joint British Resin Products, Ltd./British Geon, Ltd., factories before his appointment.

EXHIBITION FOR THE PROVINCES.—The Epikote exhibition of Shell Chemicals, Ltd., will be open at the Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham, 2, on January 11, 12 and 13; at the Central Hotel, Glasgow, on January 25 and 26; and in the Bleachers Association Assembly Hall, Blackfriars House, Parsonage, Manchester, on February 2 and 3. Invitations to these exhibitions can be obtained from Shell Chemicals, Ltd., Clarence Chambers, 39 Corporation Street, Birmingham, 2; 28 St. Enoch Square, Glasgow, C.1, and 42 Deansgate, Manchester, 3.

ANNUAL CHRISTMAS COCKTAIL PARTY.—British Artid Plastics, Ltd., held their Christmas cocktail party at the Hyde Park Hotel on December 8. It was attended by several well-known personalities in the plastics industry and was a considerable success.

INDUCTION HEATERS.—An agreement has been reached whereby Wild-Barfield Electric Furnaces, Ltd., take over the induction heating business of Wickman, Ltd. Mr. F. L. Gladwin, who has been associated with the Wickman induction heating business since its inception, has been appointed sales manager for the department by Wild-Barfield Electric Furnaces, Ltd.

NEW APPOINTMENT.—Mr. W. F. Fitzmaurice, D.S.C., has been appointed sales manager of Scott Bader and Co., Ltd. He was last year's chairman of the London Section of the Plastics Institute and prior to taking this appointment was with British Industrial Plastics, Ltd.

MEETINGS

January

14th.—Annual Dance, Plastics Institute, London Section. Monico, 46 Regent Street, London, W.1.

19th.—"Fluon," H. M. Whitcut, B.A. Plastics Institute, North-Eastern Section. Oak Room of Mining Institute, Neville Hall, Newcastle upon Tyne. 7 p.m.

19th.—"Practical Do's and Dont's in Mould Design." J. Butler, A.M.I.Mech.E., A.M.I.B.F., F.P.I. Plastics Institute, Western Section. New Technical College, Stratford Road, Stroud. 6.30 p.m.

21st.—"Improved Impact Polystyrene," S. D. Eagleton, F.R.I.C., Plastics Institute, Midlands Section, James Watt Memorial Institute, Great Charles Street, Birmingham. 6.30 p.m.

21st.—"Some Recent Developments in the Plastics Industry," E. M. Evans, B.Sc., Ph.D., A.R.C.S., A.R.I.C., D.I.C. Plastics Institute, North-Western Section, Engineers Club, Albert Square, Manchester, 2. 6.30 p.m.

February

1st.—"Surface Chemistry and Adhesion," Dr. W. C. Wake. Society of Chemical Industry, Plastics and Polymer Group, Rooms of the Chemical Society, Burlington House, London, W.1. Joint meeting with London Section, Society of Chemical Industry. 6.30 p.m.

3rd.—"Polyester Resins, their Properties and Applications," L. Vaughan. Plastics Institute, Southern Section, Polygon Hotel, Southampton. 7.30 p.m.

9th.—"Injection Moulding—Two points of view on the same subject," E. Gaspar, A.M.I.Mech.E., and a member of the staff of I.C.I., Ltd., Plastics Division. Plastics Institute, Yorkshire Section, St. Mark's House, 186 Woodhouse Lane, Leeds. 7 p.m.

9th.—"Injection Moulding Machinery," A. O. R. Johnson; "Extrusion of Thermoplastics," E. G. Fisher. Plastics Institute, South Wales and Monmouthshire Section, Cardiff Technical College, Cardiff.

Machines for the Industry

E.M.B. High-speed Press for Alkyd Moulding Compounds

The availability in this country of alkyd moulding compositions necessitates the use of fast-cycling presses if full advantage is to be taken of their speedy cure.

ALKYD moulding materials were developed originally in the U.S., in 1948. Consisting essentially of unsaturated polyesters which thermoset under the influence of heat in the presence of suitable catalysts, these resins are noted for their speed of cure. Cure times may range in a ¼-in. specimen from 145 seconds at 270° F., to 85 seconds at 320° F.

This rate of cure offers significant economies in manufacture, but also demands radical improvements in the speed of press operation; moulding conditions must be set so that a maximum of 4 seconds elapses between the time when the moulding material comes into contact with the heated mould surface and the time when full moulding pressure is applied.

With the manufacture of these fast moulding compounds in Great Britain the design and construction of a press suited to this special technique has become essential, and a range of machines is now being constructed by the E.M.B. Co., Ltd., Moor Street, West Bromwich. The first press, now in production, has been built to the requirements of Mawson Taylor, Ltd., of Radcliffe, Manchester. A general view of the press is shown in Fig. 1.

Fig. 2 shows a detailed cut-away drawing of the press. The machine is operated by compressed air up to 100 p.s.i., and has a downward thrust on the platen of 20,000 lb. through 12 in. of stroke, giving a projected area of work of 20 sq. in.

The cylinder is mounted on four pillars with adjustments for height. The platen is located by two guide bars on each side of the press.

Carried underneath the table is an ejection cylinder giving a thrust of 5,000 lb. through four in. of stroke, this stroke being adjustable by means of the stop (1). The protective sleeve (2) is removed to make stroke adjustments.

Pressure-control valves are mounted underneath the table, valve 3 controlling the moulding pressure, valve 4 the main ram return pressure, and valve 5 the ejection pressure. A handle (6) controls the movement of the main platen by means of the control valve (7). The speed of movement of the platen, the pressure applied to the moulding, and the stroke required are all adjustable. A cut-off valve (8) is fitted for the main platen.

Guarding

In line with all E.M.B. productions, particular attention has been given to the efficient guarding of the press. The folding gate (9) gives adequate working clearance for the operator and it is mechanically interlocked with the operating handle (6) so that the press cannot be operated unless the guard is closed. During the working of the press the guard is located in the closed position. This is carried out by a cam (10) on the guard spindle which is interlocked with the handle shaft (11) through the interlocking rod (12). With the guard open the interlock rod engages in a recess in the handle shaft

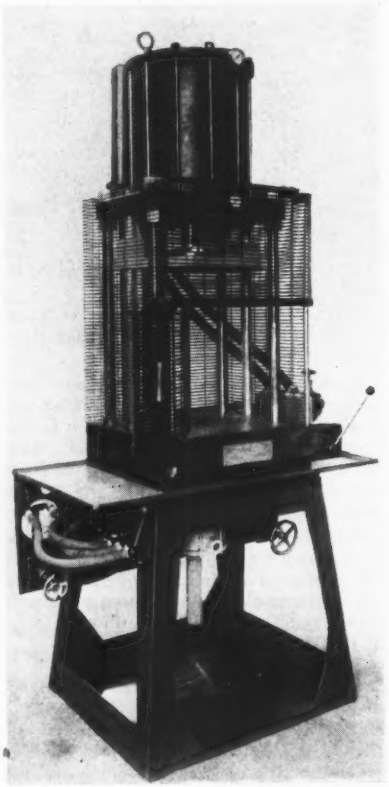


Fig. 1. A general view of the E.M.B. machine. The overall height is 7 ft. 5 in.

locking it in the operative position. When the guard is closed the interlock rod retracts and frees the handle for operation.

Operation of the Machine

The moulding compound in the form of powder or preforms is put into the die cavity and the guard is immediately closed with the left handle. The handle (6) is then moved into the operating position.

After the moulding has been cured the guard is opened and the handle (6) moved to return the platen and the work ejected by means of the ejection valve (13) controlled by the handle (14). After removing the work the ejectors are returned for the normal cycle.

Provision is made for mounting ejector boxes on the bed and electric or steam-heated platens on the bed and the moving platen.

Construction and Maintenance

Particular attention has been paid to the design of the machine to reduce maintenance to the minimum. The operating valves are of the poppet type with the E.M.B. design of synthetic rubber seating with a metal shroud to prevent overloading. These valve seats will seal for years without lapping or maintenance.

The valves are cam operated through tappets which provide accurate setting for adjustment. The cams and tappets being case-hardened, wear and friction are reduced to a minimum.

The valve blocks are machined from the solid in a corrosion resisting alloy so that no leakage between valves is possible.

The reducing valves will give a fast supply of air at the correct pressure with a quick cut-off. This is made possible by the use of a diaphragm, springs of ample capacity and the E.M.B. design of valve.

All internal sliding surfaces of the air cylinder are chromium-plated and polished so that the air seals will work for a considerable time before replacing becomes necessary. Oil mist lubricators (15) are fitted to inject oil into the air stream for lubricating the walls of the air cylinders.

Capacity

The maximum daylight offered by the press is 24 in., minimum being 12 in. The platen stroke is 12 in., thrust 20,100 lb. The ejector stroke is 4 in. maximum with a thrust of 5,000 lb. The distance between bars is 19 in. by 11 in. Space occupied by the press is 3 ft. by 4 ft. by 7 ft. 5 in. high.

Conclusion

The foregoing notes will indicate that the designers of the machine have fully appreciated the necessity for a fast-moving press. This has been achieved without sacrificing simplicity of construction and operation. As Fig. 1 clearly shows, the frame is light in comparison with the slower moving traditional presses, at the same time providing adequate strength. The controls are easily accessible, as can be seen in Fig. 2. The subsidiary sketch in Fig. 2 shows the rear of the machine.

The press illustrated is now in production, as already noted. The alkyd moulding compositions can now be utilized to full advantage, in terms of fast cure, and we may expect to see some very interesting developments in this field of moulding in the near future.

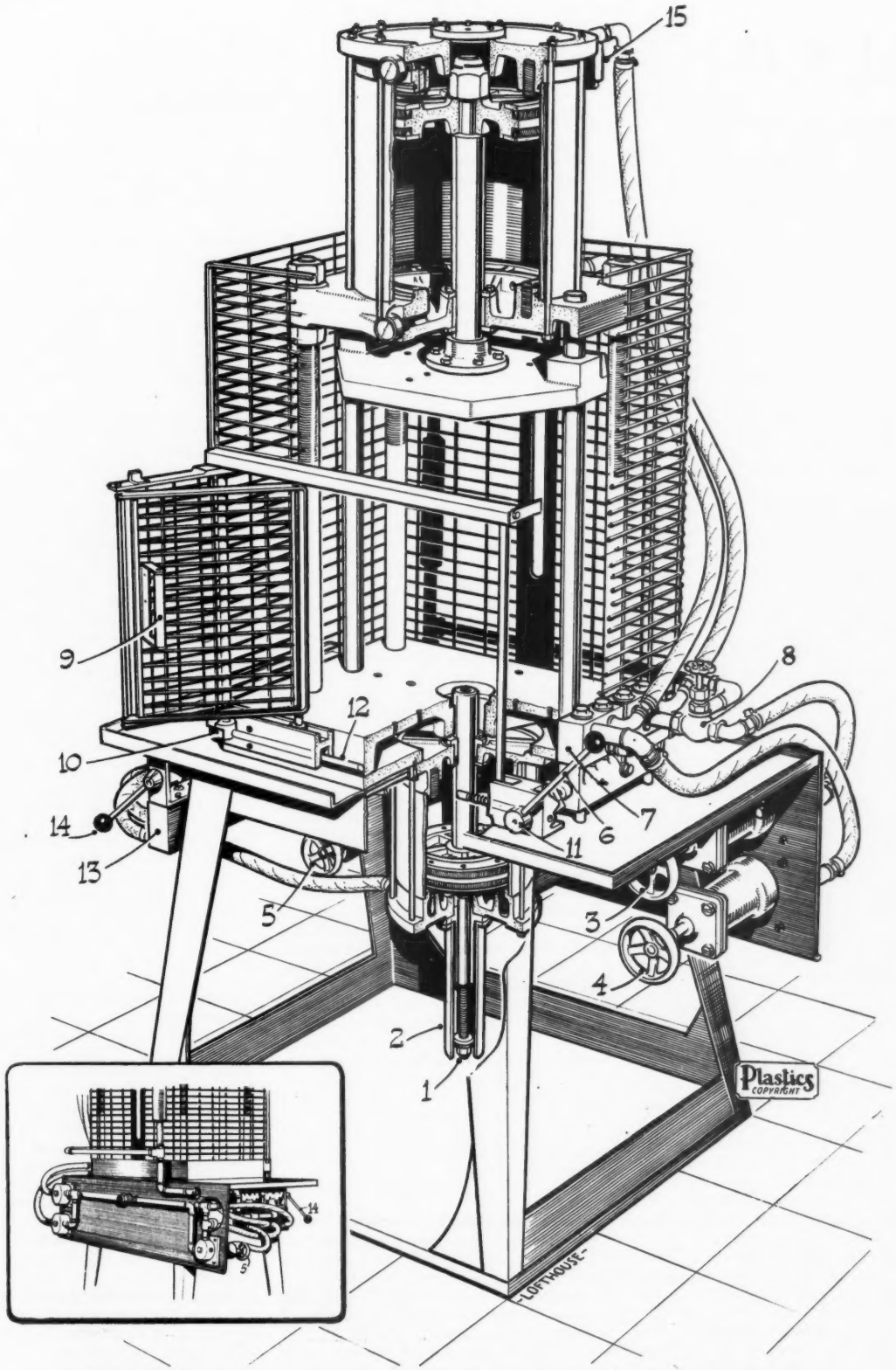


Fig. 2.—E.M.B. High Speed Press for alkyd moulding compounds. Key to drawing above: 1.—Stroke adjustment stop. 2.—Protective sleeve. 3.—Valve controlling moulding pressure. 4.—Main ram return pressure valve. 5.—Ejection pressure valve. 6.—Main platen control handle. 7.—Valve for main platen. 8.—Cut-off valve for main platen. 9.—Folding gate guard. 10.—Locking cam. 11.—Handle shaft. 12.—Interlocking rod. 13.—Ejection valve. 14.—Ejection valve control handle. 15.—Lubricators.

TALKING SHOP . . .

Epoxy Resins. Figures of epoxy resin production were given in the *Financial Times* issue for December 7. Noting that world production of these resins began in the U.S., in 1949, the paragraph stated that annual production in the U.S. is now running at 11,000 tons. The Shell plant at Pernis, in Holland, opened 18 months ago, is now producing 2,000 tons a year and the Shell plant now nearing completion at Stanlow, in Cheshire, will have a yearly production of about 1,000 tons. These resins are widely used in surface coatings, although increasing uses are now being found in many other spheres. An exhibition was held recently in London by Shell Chemicals, Ltd., of these new resins and a note appears elsewhere in this issue.

* * *

Dry Clothes for Postmen. *The East Anglian Daily Times* in its issue dated November 30 notes the approval by the Postmaster-General of new types of uniforms of protective clothing for postmen. Postmen's capes will be replaced by lightweight waterproof coats of plastics material. Following Admiralty approval of p.v.c. foul-weather clothing and the use of p.v.c. oil-skins by trawlermen, this marks another step forward in the progress of synthetic clothing.

* * *

Plastics for Bookbinding. In a recent note I mentioned the use by Walthamstow Council of plastics covers for new books, prolonging their life before rebinding was necessary very considerably. I now see that the public library at Kidderminster contemplates the binding of all books with a similar cover.

* * *

Plastics has a final "s." The common misuse of the word "plastic" when describing articles made from various types of plastics was discussed at a recent meeting of the Council of the British Plastics Federation. It was pointed out that there is the authority of the British Standards Institution for writing plastics with a final "s," this being included in B.S.1755 Glossary of Terms Used in the Plastics Industry published in 1951.

"Plastics" are defined in the Glossary as: "A wide group of solid composite materials which are largely organic, usually based on synthetic resins or upon modified polymers of natural origin and possessing appreciable mechanical strength. At a suitable stage in their manufacture most plastics can be cast, moulded or directly polymerized to shape. Some plastics are rubber-like, while some chemically modified forms of rubber are considered to be plastics. The noun," the Glossary continues, "may be used adjectivally to describe an article or substance as being composed of, or as being, a material in the group mentioned in the definition. Used thus the word is distinguished by its terminal 's' from the adjective 'plastic' signifying the susceptibility of a material to plastic deformation." The Council decided to encourage the widest possible use of the terminal "s" in the adjective in accordance with the British Standard.

* * *

Progress in Scotland. An interesting report on the progress of reinforced plastics north of the border was given in a recent issue of *The Scotsman*. Noting that Fibreglass Ltd. have a major plant at Glasgow, the report describes the work of several companies. James Mitchell and Sons (Greenock), Ltd., are now making a number of glass fibre products including trays, hoods, ducts, structural members and ventilators. Of special interest are pipes for chemical plants, bonded with epoxy resins. The report states that pipes of this kind have been subjected to 40% sulphuric acid at boiling point for months without injury.

The work of Aeroplastics Ltd. is described. Aeroplastics, the plastics division of Fairey Aviation Co., Ltd., specialize in the manufacture of air ducts, cable ducts, wing tips and numerous other jobs for the aircraft industry and others.

At Dumfries, A. C. Penman Ltd. are making parts for commercial vehicles, and at Stirling, Walter Alexander and Co. (Coachbuilders), Ltd., are experimenting with panels for bus bodies. A thriving industry up there.

* * *

Bad Reporting. In another note on this page I draw attention to the excellent Press the plastics industry has had during the past year in the financial papers. Now a complaint; lest the brick I throw should hurt too much I will not name the paper which published the following: "American scientists have discovered a plastic—epoxy—which is almost as tough as steel, and may replace it in the manufacture of certain products. Epoxy—which is cheaper and easier to produce than metal—is at present being used in tools, dies and fixtures now helping to turn out America's 1955 car models." This report was circulated by a reliable agency. To anyone who knows anything of our industry, it is just so much nonsense so far as cheapness and ease of manufacture is concerned. But to the non-informed reader it either cheapens the industry or entirely misleads him. And at 7s. 6d. lb. epoxy resins are a little more expensive than the majority of metals.

* * *

Finance and Plastics. On several occasions recently I have quoted comments on the plastics industry which have appeared in the big financial papers. Now I report a two-page article which was published in the *Investors Chronicle* for December 4. Headed "Progress in Plastics," it was the first of two articles to explain briefly to the reader the nature and structure of the plastics industry.

Coming as it does on the heels of so many other informative and mainly accurate articles of a similar kind in similar journals, it assumes a signficance which may not at first be apparent. For long the City has viewed our industry with suspicion and many of the industry's veterans will recall the difficulty before the last war of obtaining capital. Today, financiers are not merely buying plastics shares as "blue chips." They are becoming informed through their own specialist papers on the industry's structure and possibilities. This can only react favourably upon plastics since it will stimulate public investment and enable us to consolidate the rapid progress of the last 15 years.

* * *

Boats in Glass Fibre. The National Boat Show at Olympia, sponsored by the *Daily Express*, brought a whiff of the sea to wintry London. Many of the journalists who visited the Show came away impressed by the boats displayed which were made from glass fibre bonded with polyester resins. Amongst the exhibits were the Magdalen eight and the Admiralty Dory built by Tod and Co. of Weymouth. The work of this company has received frequent mention in *Plastics*; this latest product to be seen by the public, the Dory, was sent on to Scotland on completion to be tested by the Royal Marine Commandos. I cannot imagine a tougher testing ground and I am pleased to report that it has come through with flying colours and apparently withstands the harsh beaching treatment better than its wooden counterpart.

* * *

Factory Record. At midnight on December 19 the employees at the Ruabon factory of Monsanto Chemicals, Ltd., completed two million man-hours of work without a single lost-time accident.

The factory employs approximately 2,000 men and women on the production of industrial chemicals and commenced its unbroken accident-free run on July 17, 1954.

This establishes a new record for the Ruabon factory, the best previous achievement being 1,799,670 accident-free man-hours set up in June, 1938.

* * *

Design Committee of Plastics Institute. Readers will know of this committee, recently set up, to canalize the design talent in the industry. A first-class idea and one which will do much to further the industry's interests.

News of the committee has also reached Miss Eileen Anderson who writes a column in the *Daily Dispatch*. "I welcome the news that experts are to consider ways and means of improving the design of plastics goods . . . my pet room-for-improvement plastics are cups, saucers and plates . . . their design is dull and dreary."

Miss Anderson will be pleased to hear that we too are for improved design, particularly in bringing decoration to the otherwise excellent melamine tableware. We shall be publishing soon the results of our tests on the decorated cups and saucers we showed in the September issue of *Plastics*. These were typical mouldings which were painted with attractive designs by an artist. The decoration was then protected by the application of a synthetic resin sprayed film.

PLASTIKON.

The Use of Epoxy Resins in Modern Tool Manufacture

By Dr. K. MEYERHANS *

A conference on Plastics Tooling was convened in October last year by the Sheet and Strip Metal Users' Technical Association. Certain papers read at that conference have been published in "Plastics." The following, reproduced with the permission of the author and the Association, is the last in the series.

ONLY a few years ago, the idea of "synthetic resin tools" was almost unheard of—not because tool manufacturers had no interest in simpler and cheaper manufacturing methods, but chiefly because no suitable synthetic raw materials were available from which dimensionally constant and accurately shaped tools of any desired pattern could be made. On the other hand, there were mouldable derivatives of the ethyl-cellulose thermoplastics. These by reason of their flexibility can, in fact, stand up to high impact stresses, but, considered generally, their mechanical strength is poor and they are only slightly water resistant.

The phenol-formaldehyde condensation products, capable of being hardened, should also be mentioned. The first mouldable resins used for tool manufacture were brittle and the setting process caused a considerable shrinkage. Though with the passage of time they have been considerably improved, through the development of suitable filling and setting agents, tools manufactured from these resins are still relatively brittle and thus unable to stand heavy stresses. Their surfaces are very porous and the effect of humidity causes variations in their dimensions. After setting of the castings at ordinary room temperature, in most cases a second oven hardening is necessary. The catalysts used for the setting are acid, so that metal parts coming in contact with the resin must be protected again corrosion. If these cast resins are still to be included, even today, among synthetic resins for tool manufacture, it is chiefly on the score of their cheapness and simplicity of preparation.

Phenolic resins in the form of laminated paper materials have also been used for tool manufacture, and are still in use today. This material can be easily processed, its mechanical strength is outstanding and it is relatively light in weight. It is, however, also sensitive to humidity, and correspondingly lacks dimensional stability. It does not satisfy one of the most important requirements for raw materials for tool manufacture, viz., direct moulding of given pattern contours.

During the Second World War, unsaturated polyester resins were developed. Their most important characteristics are: elimination of the solvent, setting at room temperature without application of pressure and without evolution of volatile components. It will at once be appreciated that, at a time when metals were in short supply, the aircraft industry, with its numerous small parts, its new constructions and changes of tools, seldom having flat surfaces or straight boundary lines, which had to be realized with the utmost speed, at once adopted this new class of resins. Since there is a strong exothermic reaction with the polyester resins, when processed in large quantities, and in consequence, a marked shrinkage when cured, their use, in combination with glass cloth or mats, is restricted to the production of thin-walled shells or, combined with glass fibres, to the manufacture under pressure of thick-walled components, necessitating the provision of pressure-resistant patterns and moulds.

In the years 1945 and 1946, the first representatives of a further, new class of resins appeared—the so-called ethoxyline or epoxy resins. Developments in the following years were of great importance for tool manufacture. These will be discussed in subsequent sections, under the following aspects:—

Properties of the ethoxyline resins.
Tool manufacture (patterns, fixtures) by lamination processes.
Latest developments in manufacture of tools by casting for plastic deformation of sheets.
The use of bonding agents in the manufacture of blanking and piercing tools.

Figs. 1-3 show, diagrammatically, the possible applications of ethoxyline resins in toolmaking.

Properties of Ethoxyline Resins

If the ethoxyline resins, in spite of higher prices, have so rapidly acquired a key position in tool manufacture, as compared with other synthetic resins already mentioned, this is due basically to certain particular properties. Among others should be included:—

Setting at room temperature without application of pressure.
Setting without giving off volatile substances.
Setting without, or with only slight shrinkage.
Good adhesion to most materials, such as metals, glass, ceramics, etc.
Outstanding mechanical strength in the hardened state.
No corrosive effect on metals.
Extensive possibilities of filling with inorganic and organic, pulverized, fibrous and textile agents.
Possibility of storage for almost indefinite periods, provided resin and setting agent are not mixed.
Possibilities of general application of resins as bonding agents, cements, casting resins and laminating resins.

Table I gives numerical values of the mechanical strength properties of a cold-hardened ethoxyline resin. The pure resin is contrasted on the one hand with resin containing inorganic fillers, and on the other hand with resin-bonded glass fabric. Table II shows the resistance of abrasion of various materials under discussion.

Manufacture of Tools (Patterns, Fixtures (Figs. 4 and 7)) by Lamination Processes

The method most frequently used today for manufacturing tools from ethoxyline resins resembles the lamination processes already known in the preparation of polyester resins. Under the general designation "tools" are here included in particular:

Patterns, e.g., negative-patterns, duplicate patterns.
Keller patterns or spotting racks.
Fixtures for welding, drilling, assembly, checking, routing and trim fixtures, also
Prototypes of all kinds.

In principle, such tools are manufactured as follows (for the purposes of example, the production of a negative-pattern is described):—

1. Since all ethoxyline resins adhere strongly to most materials, the original model must be coated with a parting compound. Since the surfaces of the negative model will present an accurate copy of the surfaces of the original model, the preparation includes smoothing of any surface irregularities. There are various treatment methods for use with original models. The following, for example, has proved satisfactory.

First, a thin, even layer of a parting lacquer is applied with a brush or spray gun and then left to dry at room temperature or under infra-red radiation. This is followed by a homogeneous waxing with a hard wax in the form of a paste. Once the wax layer has set, it is polished with a wool rag. As a third layer, two thin and

TABLE I. Some mechanical properties of Ethoxyline resins hardened at room temperature, with and without filters.

Test	Standard	Dimension	A	B	C
Specific gravity	VSM 77109	g/ccm	1.15—1.2	1.65—1.75	1.8—2.1
Impact bending strength	VSM 77105	cmkg/cm²	15—20	2—3	>—40
Bending strength	VSM 77103	kg/mm²	9—11	3—4	40—50
Tensile strength	VSM 77101	kg/mm²	6—8	2—3	40—50
Elastic limit	VSM 77111	kg/mm²	300—350	550—650	2,000—4,000
Compression strength	VSM 77102	kg/mm²	9—10	7—8	45—60
Heat resistance	Martens	deg. C.	50—60	50—60	50—60
Moisture absorption	10 days at 20°C.	Weight%	0.3—0.5	0.8—1.0	0.1—1.0
Linear coefficient of thermal expansion	Special test	deg. C.	90—95×10⁻⁶	50—60×10⁻⁶	10—20×10⁻⁶

A.—100 parts by weight Araldite casting resin M; 8–9 parts by weight Hardener 951.
B.—100 parts by weight Araldite casting resin M; 8–9 parts by weight Hardener 951; 200 parts by weight Filler M.
C.—100 parts by weight Araldite casting resin M; 8–9 parts by weight Hardener 951; about 100–120 parts by weight Glass Fabric Type 181.

* Ciba Ltd

homogeneous coatings of parting lacquer are applied. This layer is similarly treated with the hard wax. (Fig. 4 (1-4).)

If it is considered expedient to mould-in the original model, then, of course, the inner faces of the wooden moulds are pretreated. Moulding-in is only necessary, however, if sharp-cornered joints are required on the negative-pattern, or if its sides or ends must be enlarged.

2. To prevent the glass fabric built into the laminated structure from appearing at the tool face, a resin layer in the form of a paste, enriched with a fine inorganic filler or metal dust, is brushed or spread on with a spatula in a homogeneous layer about 5 mm.

TABLE II. Standard wear resistance of some tool materials.

Material	Loss of weight milligrams
Gypsum	5,000
Araldite casting resin M; hardener 951 (used 'o' backing)	450—500
Araldite paste 131; hardener 951 (used for working faces)	200—250
Aluminium alloy	230
Steel, hardened	85
Cast iron (grey)	25

Abrasion values determined by the Taber Abraser Model 140 of the Taber Instrument Corporation, North Tonawanda, N.Y., U.S.A. Load: 500 grams; speed: 1,000 r.p.m.

to 10 mm. thick. In the case of recesses and sharp-cornered projections, the paste is applied in a thicker layer, so that subsequently, after application of the first glass fabric layer, it can be evenly distributed over the whole surface. (Fig. 5 (5).)

3. When all the paste is distributed, after 1½ to 2 or more hours, a glass cloth previously cut to size on the original model, and impregnated with resin, is placed on it. The fabric is pressed down well into the paste, so that the paste fits closely to the model and any air inclusions which may still be present are pressed out. Care must also be taken to ensure that an intimate contact is made between the paste and the first glass fabric layer. Finally, depending on the size of the pattern, two or more additional impregnated glass cloths are applied and pressed on. It may be possible to apply the cloths together at once, depending on the type of resin, or the resin is sometimes cured after the application of two tissues. When the required layer thickness is obtained, it is set at room temperature for at least 14 hours. (Fig. 5 (6).)

The proportion by weight of glass fabric to resin is usually 1 : 1.

4. To ensure that the shell, prepared in this way, is dimensionally stable, and can be more easily manipulated with the negative-pattern, the laminated structure is reinforced. This can be done in various ways. For example, with negative-patterns of large overall dimensions, the shell is provided with a fine-meshed frame of aluminium or steel tubes. Saving in weight can be obtained if synthetic tubes or cardboard tubes, covered with glass fabric bands and ethoxyline resin are substituted for the metal tubes. These tubes are placed, as far as possible, along the stressed faces of the laminated structure and then braced back on themselves. The shell is joined to the frame by ethoxyline-resin paste.

Another method consists of constructing the reinforcement in glass fabric laminated plates, which are not sensitive to humidity. These sheets follow the contours of the shell at the front and cross at intervals of 40 cm. to 60 cm. The resulting square cells are filled to a depth of 5 cm. to 10 cm. or more with ethoxyline resin to which specific light fillers are added. (Fig. 7.)

5. The resin used for the preparation of the reinforcing layer is left to set at room temperature for a minimum of 24 hours before the finished negative pattern is de-moulded.

The negative-pattern is then tested for accuracy of fit and if satisfactory it is again placed on the original model and allowed to remain there for two or three days.

Patterns manufactured in this way are used in their strengthened and reinforced form as Keller patterns or spotting racks, also as templates of various types, or, starting with these negative-patterns, others of the same type are built up in the same way. Duplicates of original models can be produced in any required number, each duplicate corresponding exactly to the original model.

If the manufactured tools are to be used as drilling, welding or assembly fixtures, then their ends and sides are lengthened to enable the requisite jigs to be attached. In the case of drilling jigs, for instance, in order to be able to introduce the drilling attachments, the openings in the finished laminar shell are in the first instance drilled oversize, after which bushes are inserted in these openings and cemented or cast in with ethoxyline resin.

In order to economize in weight and material, only the surfaces required in operation and for reinforcing are laminated.

Apart from the negative-patterns described, car-body and aircraft components are manufactured from ethoxyline resin and thin glass fabrics, of the same thickness as the final sheet components. These prototypes are of great value for testing purposes, for development work, in production planning, etc.

The sheet thickness is allowed for by lead foils, wax layers, rubber mats, synthetic foils, sheet-metal or synthetic prototypes, placed between the existing model and the pattern to be made.

Such patterns and templates have the following advantages:—

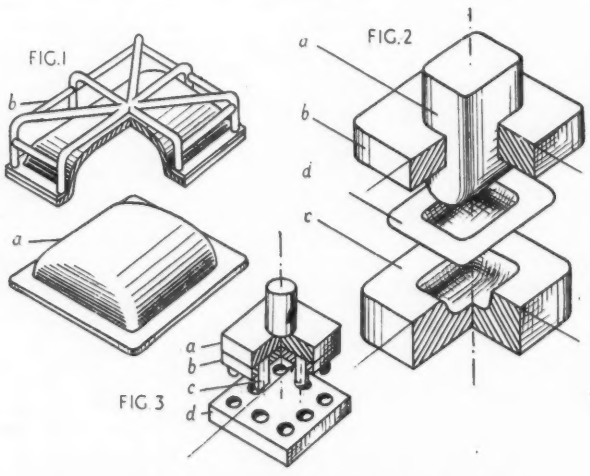
They are simple in manufacture, since the resins can be applied at room temperature and without pressure on any patterns in gypsum, wood, metal or synthetic material.

They can be produced cheaply, since the work can be performed in a short time by unskilled or apprentice labour.

They can be manufactured true to shape and without, or with only a little, further processing.

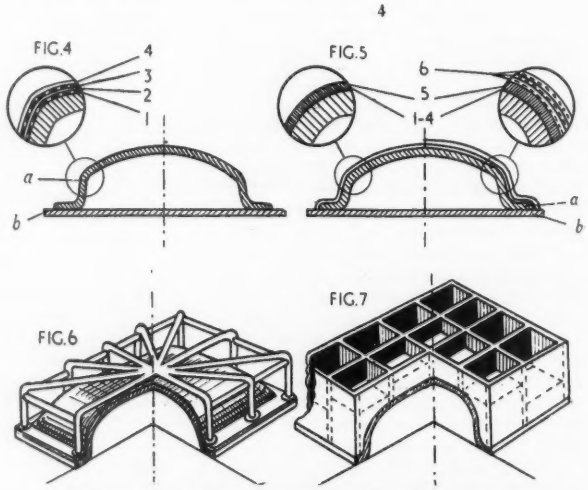
They have great dimensional stability.

They have outstanding mechanical strength, so that no danger of fracture arises with free falling.



Survey of the possible applications of ethoxyline resins in tool making.

Fig. 1. Production of patterns and jigs by the lamination process. (a) Pattern. (b) Finished counter-pattern of ethoxyline resin, consisting of a glass fabric laminated shell with stiffening. Fig. 2. Production of drawing dies by the casting process. (a) Punch. (b) Holding ring. (c) Die. (d) Work. Fig 3. Assembling piercing tools. (a) Head plate. (b) Punch holder plate. (c) Punch, cemented in place. (d) Die.



Production of patterns and jigs from ethoxyline resins by the lamination process.

Fig. 4. Preparation of the pattern. (a) Pattern. (b) Base plate. (1) Pattern lacquering. 2) Wax coating (3) Parting coat 4) Wax coating. Fig. 5. Building up the counter pattern. Production of the shell. (1-4) Shaping as Fig. 4. (5) Coating of ethoxyline resin paste. (6) Laminate consisting of several ethoxyline resin-impregnated glass fabric layers. Fig 6 Stiffening the counter-pattern by tubular framing. Fig. 7. Stiffening the counter-pattern by cellular framework.

They are largely insensitive to acids, alkalis, fats, oils, greasing agents and the usual solvents.

They are insensitive to humidity. They do not corrode, so that they can be stored in the open.

Their surface is smooth, hard and tough.

They are light in weight, so that they can be manipulated easily and without effort. For this reason, they can be transported cheaply.

Latest Developments in Manufacture of Dies (Figs. 8-15)

For the manufacture of dies, i.e., tools for plastic deformation of sheets (stamping, drawing, casting, stretch forming) and for similar purposes, the lamination methods described can be used. Since, however, such tools require a substantially more solid type of structure, the building on of layer to layer is a very tedious process. A considerable simplification is possible, however, if they are not laminated, but are cast.

Due to the large mass of material, however, there will be a considerable exothermic reaction with consequent shrinkage unless special methods are taken. After considerable work these difficulties have been overcome by the use of a particular proprietary type of ethoxyline resin, filler and hardener.

This mixture has, among others, the following properties:—

Pot life is from 1½ to 2 hours.

The maximum exothermic reaction temperature occurring, tested on a 200-kg. (440-lb.) casting, was at most 60° to 70° C. An essential prerequisite is that the mixture is prepared at a temperature of 15° to 20° C. and that the room temperature at which the cast is cured does not exceed 20° C.

Shrinkage through curing is almost nil.

Curing is completed at room temperature in 14 to 24 hours. The tools manufactured have, in addition to the properties of synthetic tools already mentioned above, the following additional advantages:—

Their manufacture is simple since the resins can be cast in the required shapes from plaster of paris, wood or metal, and since curing is completed at room temperature without application of pressure.

Mechanical strength values are exceptionally good since glass fabrics, mats or fibres, steel components, etc., can be built into the resin mass. Metal parts do not corrode.

Repairs or alterations can be completed speedily and without difficulties when indentations are made or recesses cut.

Machineability is good.

Tools no longer required can be broken up and will serve in a crushed state as filling material in the preparation of new components.

The following passage describes, first, the manufacture of a tool component, e.g., a die for a punch or blankholder; then the working sequence in the manufacture of a complete tool outfit.

1. When the pattern and mould material has been provided with suitable separating layers, the building-up of the tool components involves two working processes.

2. The working surface of the tool—that is the surface which is in direct contact with the sheet to be shaped—is first prepared by spreading an ethoxyline paste carefully on the pattern and mould walls. The thickness of the layer is generally 2 mm. to 5 mm., but in places at which a subsequent shaping is to be anticipated, e.g., for the preparation of beads in blankholders, it must be enlarged to 10 mm. to 20 mm.

3. Finally, the hollow space remaining, the backing, is filled at room temperature with the casting mass consisting of ethoxyline resin, filler and hardener. The minimum layer thickness should be 100 mm. After subsequent curing at 15° to 20° C. for at least 24 hours, mould and pattern are removed.

If economies in casting material are necessary, hollow spaces can be left by using core moulds, or metal blocks, chips and fragments of worn-out tools can be inserted in the still uncured casting resin mass. Economies in casting resin can also be made in some cases if metal reinforcement is cast integrally with the resin in the remaining skeleton moulds. This process may even be essential if, for reasons of space, the layer thickness of the tool, perpendicular to the direction of pressure, is not sufficient to be able to absorb the tangential tensile-stresses force.

Tools manufactured by the methods described above are, in the interests of simplification, in most cases provided with an iron baseplate. This can be done in two ways. If the joint is not made until after the resin is cured, then the back of the tool must be machined. This is usually done with hard-tipped tools. Tool and baseplate can then be joined by screws, in which case threaded holes must be provided in the tools. This can be effected by moulding threaded bushes directly into the resin.

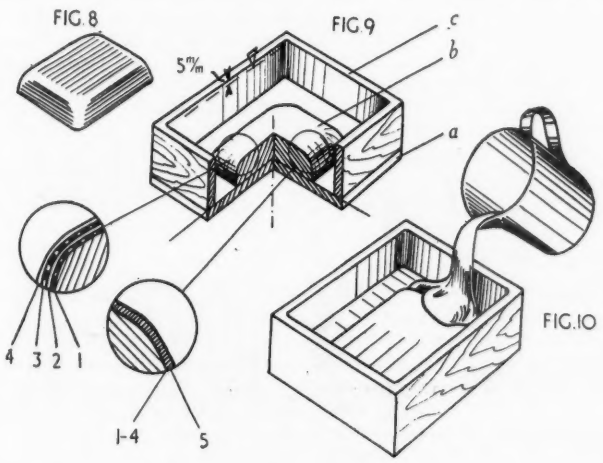
The joining of the tool to the baseplate can also be made by providing the latter with welded tie-bolts. The resin is poured through inlet apertures provided in the baseplate until it emerges through vent holes. During the curing process, the resin unites firmly with the baseplate and the tie-bolts. With this method of working it must be ensured that the baseplate is held in the correct position on the mould.

The guide bars are preferably of metal, and they are screwed on.

If, when centring the tools, the countersinking is carelessly done, the connecting parts between the baseplate and the tool component may break. In order to give the material at this point a substantially higher mechanical strength, additional glass fibres, glass fabric scrap and the like should be incorporated with the casting.

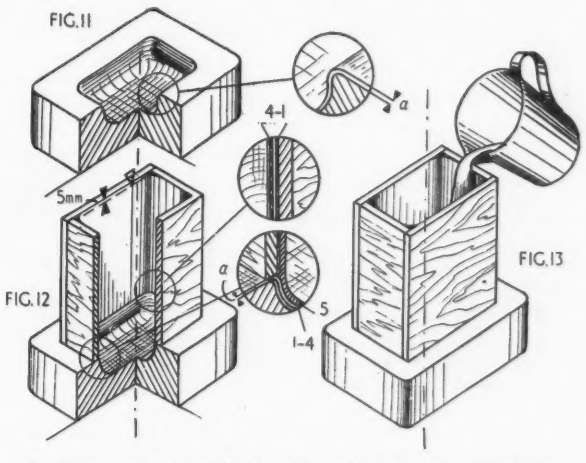
Broken or damaged tools can at once be made serviceable by again pouring resin, filler and hardened mixture on the backing, or by applying paste and hardener to the working surfaces.

To make the material of the working surfaces sufficiently strong to meet extremely



Production of a draw die by the casting process. Preparation of the model.

Fig. 8. Model plate. Fig. 9. (a) base plate, (b) template, (c) wooden frame, (1-4) handling of the mould, (5) slip layer of Araldite Paste 131, Hardener 951. Fig. 10. Pouring the model with Araldite casting resin M/Filler M/Hardener 951.



Production of a draw die by the casting process. Production of the punch.

Fig. 11. Slip faces of the mould, coated with rolled-lead foil. (a) lead foil of same thickness as sheet material. Fig. 12. Mould according to Fig. 11 with wooden frame in place for making the punch. 1-4 Treatment of the mould. (5) Slip faces, of Araldite Paste 131, Hardener 951. Fig. 13. Pouring of hardie punch, from Araldite casting resin M/Filler M/Hardener 951.

high requirements, it is advisable to incorporate metal. This can be done by placing metal reinforcements on the pattern and then applying ethoxyline paste, or, by using the same product, the metal components can be embedded in grooves prepared in the synthetic resin mass.

To increase the stability of the paste layer, which in this case is only 1 mm. to 2 mm. thick, glass fabric impregnated with unfilled resin hardener mixture is applied. It must be ensured that no air inclusions are allowed to remain. The backing is then usually made with the same formulation.

Hardened resin that is to be combined with fresh resin, as in the case of repairs or the insertion of metal reinforcements, should be cleaned with ethyl acetate.

Metal parts which are not to be removed are degreased and derusted before embedding; metal parts to be removed, e.g., core moulds, are treated at the surfaces with a thin layer of silicone grease.

The following paragraphs describe the preparation of a tool set. It is assumed that the tool consists of a punch, die and holding ring, the master pattern being a model of the punch, the face of which corresponds to the draw face of the punch plus the thickness of the blank; and in which the metal baseplates are only subsequently joined to the resin parts by screwing. On this assumption, the following sequence must be observed: die, punch, blankholder.

1. Die (Figs. 8-10)

(a) The pattern plate is laid on the baseplate and attached thereto. The reference face of the baseplate corresponds to the working face of the finished die. The thickness of the template equals the thickness of the blank less the thickness of the fin or flash. (Figs. 8 and 9.)

(b) A wooden frame is fitted on top of the reference face and attached thereto. This wooden frame represents the outline of the die. Since the back of the die will later have to be machined true, the wooden frame should be raised 5 mm. (0.197 in.).

(c) All surfaces coming in contact with the resin are treated with a suitable release agent. (Fig. 9 (1-4).)

(d) Preparation of the working faces using the paste. (Fig. 9 (5).)

(e) Filling up the existing shell with the resin filler/hardener mixture. (Fig. 10.)

(f) After subsequent curing it is removed from the mould and the separating films, attached in some cases to the ethoxyline resin tool, are removed.

2. Punch (Figs. 11-13)

(a) The face of the die which comes in contact with the sheet in the drawing process is coated with a lead foil, the thickness of which equals that of the sheet. The lead foil should lie completely smoothly on the die and the surface should be free from scratches. (Fig. 11.)

(b) On the lead foil a wooden frame is placed corresponding to the outline of the punch, and fixed. (Fig. 12.)

(c) All faces are provided with separation layers.

(d) and (e) Exactly as 1 (d) and (e). (Fig. 13.)

(f) The wooden frame is removed.

3. Blankholder (Figs. 14, 15)

(a) Care must be taken to allow for the necessary air gap of 0.3 mm. to 0.5 mm. between the punch and the blankholder; a drawing paper, a thin paste board or a metal foil is pasted on the punch. The same purpose can also be served by a three- to four-layer application of parting agent.

(b) All surfaces are provided with separation layers.

(c) Ethoxyline paste is applied. (Fig. 14 (5).)

(d) The wooden frame, also provided with separation layers, which determines the outline blankholders of the plate, is erected.

(e) The prepared wooden frame is filled with the resin filler/hardener mixture. (Fig. 15.)

(f) After the curing of the resin, the die is removed, the lead foil torn off, the punch withdrawn and the paper removed. The faces are, where necessary, machined true.

The baseplates are then screwed to the die and to the punch and the lateral guide bars fitted to the blankholder and die.

It will be apparent from the first pressing trials whether it is necessary to provide drawbeads to prevent the formation of creases in the drawn sheet. If no provision has been made for this at the start, a number of grooves are milled in the blankholder, depending on requirements, and the metal beading strips are stuck in and ground to shape. Matching grooves are formed in the die.

Such cast tools are not restricted in use to drawing, stretch-forming and embossing sheets, but they can also be used as moulds for pressing laminated materials, consisting of glass fabric or glass mats and unsaturated polyesters or ethoxyline resins in low-pressure processes, and for the forming of thermoplastic synthetic foils or sheets in a vacuum. In the field of application of casting resins is also included the manufacture of patterns and moulds in core and moulded sand preparation in metal castings and of Keller patterns in the metal-spray-casting technique.

The Use of Bonding Agents in the Manufacture of Blanking and Piercing Tools (Figs. 16, 17)

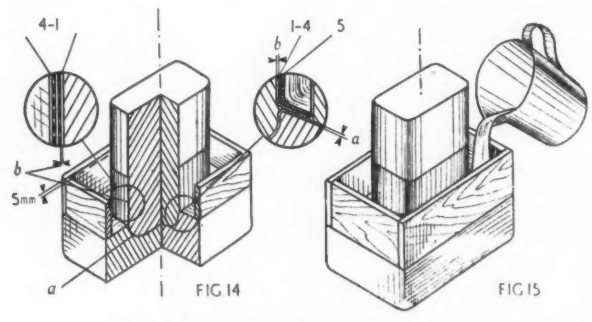
As has been observed in the earlier sections, the range of application of the ethoxyline resins in tool manufacture is exceptionally wide. The picture would be incomplete if yet another application is not described, in which, in the main, the adhesive power of the resins finds application. This is in connection with the fixing of cutting punches in punch-holding plates, instead of the usual soldering. This new, simple method offers great advantages, particularly in the case of multi-punch cutting tools, as required, e.g., in the preparation of rotor and stator blades.

The punches can be hardened along their whole length, since no softening of the punch head occurs as with soldering. The use of soldering fluid and the rust formation connected with this is eliminated. The bonding agent cures at room temperature or, to shorten the manufacturing process, temperatures can be raised slightly, so that softening or distortion of the hardened-steel parts does not occur, and edges free from burrs are obtained.

Generally, the working process is as follows:—

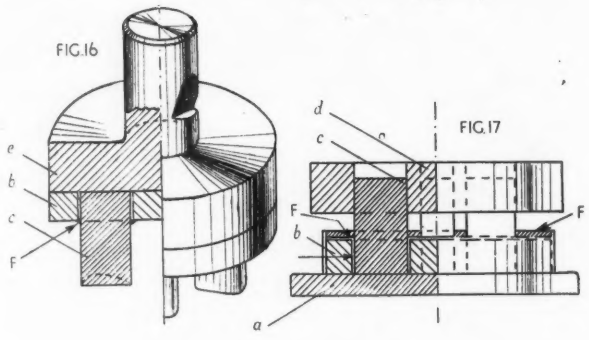
Punch, punch-holding plate and die are prepared as usual. The punches are hardened along their whole length. Between punch and die, a cutting space is provided corresponding to the sheet thickness to be punched. The clearance between the punch and the matching recesses in the punch-holding plate should be at least 0.2 mm. (0.008 in.) on the diameter, i.e., 0.1 mm. (0.004 in.) on each side, in order that the

(Continued on page 32)



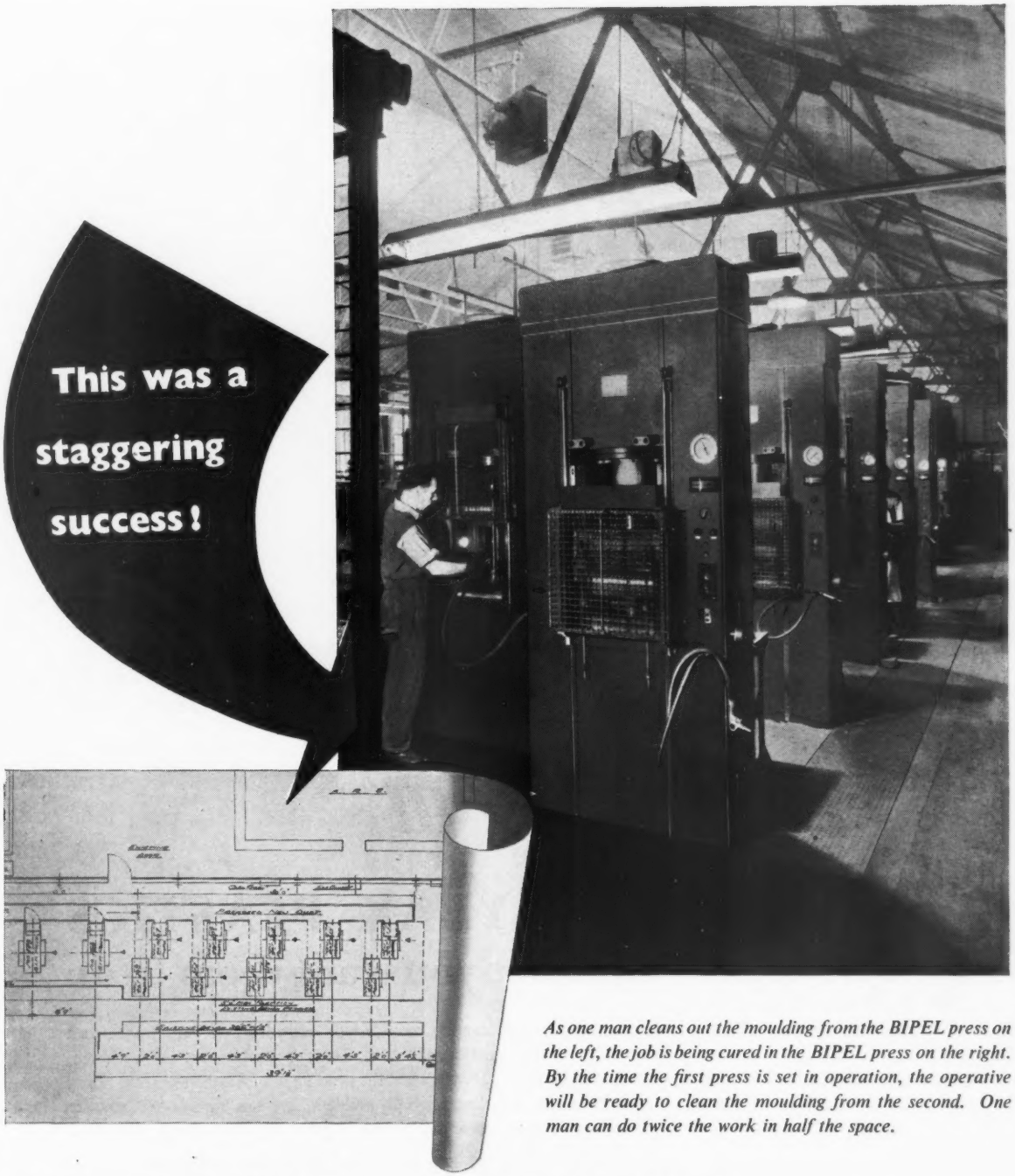
Production of a draw die by the casting process (continuation). Making the holding ring.

Fig. 14. Mould according to Fig. 11 with draw die and wooden frame fitted for making the holding ring (a) Rolled lead foil of same thickness as sheet material (b) Draw die circumference to height of holding ring with a coating of thickness corresponding to working clearance (1-4) Shaping stages (5) Slip layer consisting of Araldite Paste 131 and Hardener 951. Fig. 15. Pouring holding ring with Araldite Casting Resin M/Filler M/Hardener 951.



Assembling piercing tools.

Fig. 16. Finished tool component with assembled punch. Fig. 17. Arrangement of parts for joining (a) Bottom plate (b) Die-holder plate (c) Punch (d) Bottom die (e) Headplate (f) Bonding layer.



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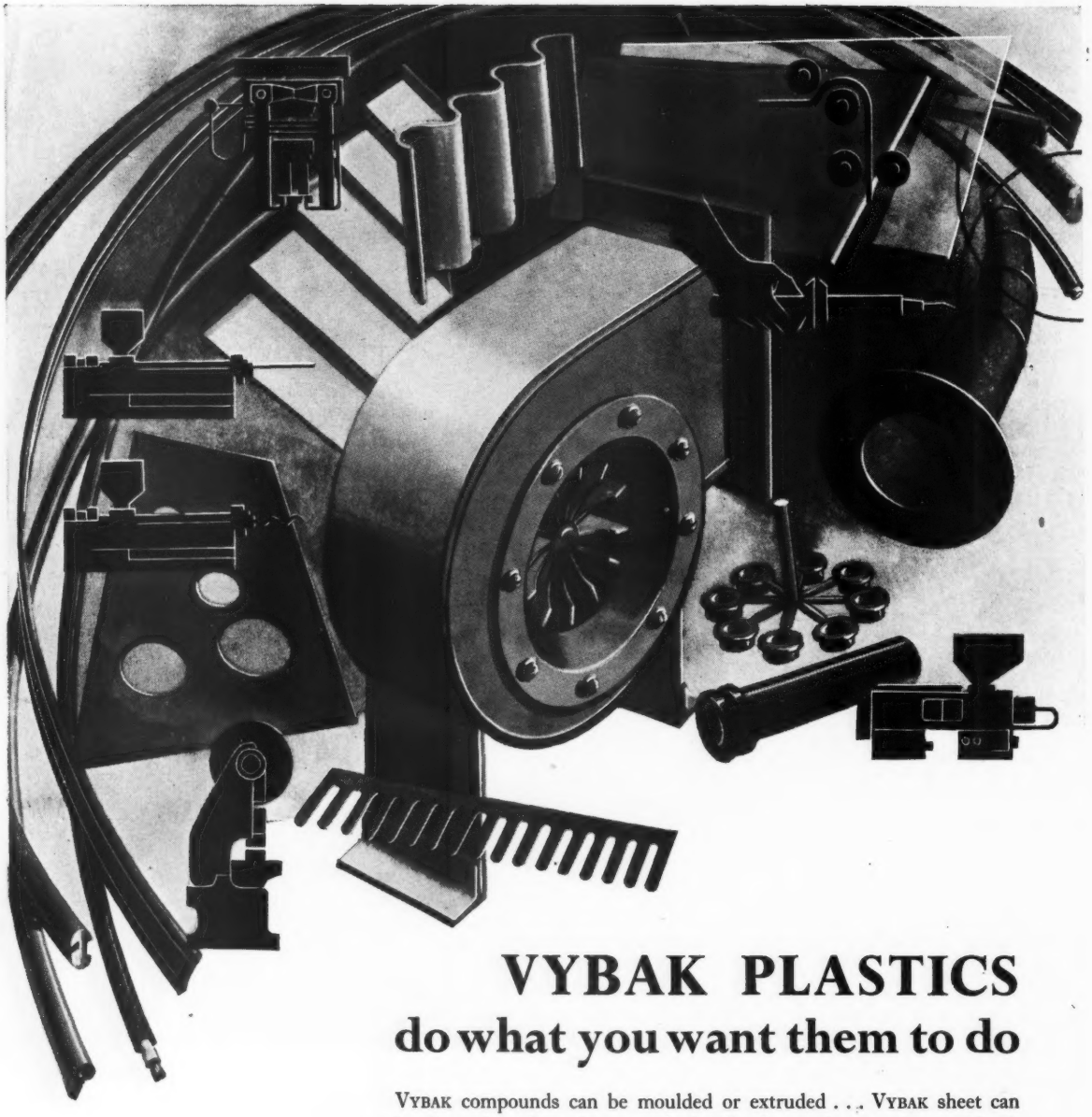

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VP23

A New Application of Dielectric Heating

By A. BLAKE, B.Sc., A.P.I.*

In the following article the author first briefly discusses the theory of dielectric heating and notes the main applications of the process. He then discusses a recent development, the use of dielectric heating in the manufacture of rollers for certain purposes such as leather tanning, printing, and duplicating. The method of mould manufacture is described.

IN the plastics and allied industries the use of dielectric heating is now well established. This form of heating is already used for:—

(a) Preheating moulding materials.
(b) Heating glue bonds.
(c) Welding plastics materials.
(d) Baking foundry cores.
(e) Drying various materials.

Other less-known applications are no doubt also being used.

The process is essentially the same in each case. Between the metal electrodes of a heating unit is placed the material to be heated, thus forming the dielectric of a condenser. When the high-frequency current is applied across the plates, the material can be heated to the required temperature using time and distance apart of plates as the variables.

The power absorbed by the material can be shown to be

$$P = \frac{5.58 \times 10^{-7} f E^2 \epsilon \tan \delta}{\rho d^2}$$

where P = Power absorbed in watts/gram
E = Applied voltage
ϵ = Dielectric constant of the material.
δ = Power factor of material
ρ = Density of material
d = Distance apart of electrodes.

The actual time of heating can theoretically be determined from:—

$$t = \frac{1.25 \times 10^5 \, S\theta \, \rho \, d^2}{f \, \epsilon \tan \delta \, E^2} \text{ min.}$$

when S = Specific heat
θ = Increase in temperature.

The calculated time does not allow for radiation losses and therefore in practice the time calculated as above would give a lower value than the correct one.

One great advantage of dielectric heating is the saving of time, and in many cases an extremely fast moulding cycle is obtained. This enables production to be speeded up considerably, with the obvious result of lowered cost.

Polyvinyl chloride in a plasticized form is used for making rollers for certain purposes, such as printing, duplicating and leather tanning. Various methods have been adopted to mould these rollers. British Patent 684,473, which describes the casting of rollers from a vinyl chloride composition, is a typical one. The gelling of the vinyl mass is accomplished by heating it to a temperature of about 160° C. for a time, depending on the size of the roller.

Now it will be seen how important it is to find a quick method of heating when it is realized that a roller 1½ in. diameter by 12 in. long, for example, takes at least one hour to gel fully. If it were found practicable to use dielectric heating, a great reduction in this time would result. With this view in mind, certain experiments have been carried out, and an outline of the results obtained and difficulties encountered is indicated below.

The first test was to examine the effect of dielectric heating on a mass of plasticized polyvinyl chloride. A quantity of p.v.c. paste was made up and then thoroughly de-aerated and one pound of it placed in a porcelain dish between the plates of a 3-kW. dielectric preheating unit. This mass was completely gelled in two minutes. Placed in an electric oven at 160° C., the gelling time for a similar mass was 60-65 minutes. A large reduction of gelling time was indicated by this initial test.

The next step was to adapt the heating unit to take a cylindrical mould. Two copper electrodes 12 in. by 2½ in. by 16 gauge (Fig. 1) were connected to the electrodes proper of the unit by flexible copper strips. The electrodes were mounted on a teak frame by means of ceramic insulators. The mould was fixed on to a wooden base which was attached to a variable-speed motor.

Some difficulties arose in finding a suitable material for the mould. Normally, a mould of this type consists of three parts, viz., (a) main cylinder, (b) base, and (c) locating spider (Fig. 2).

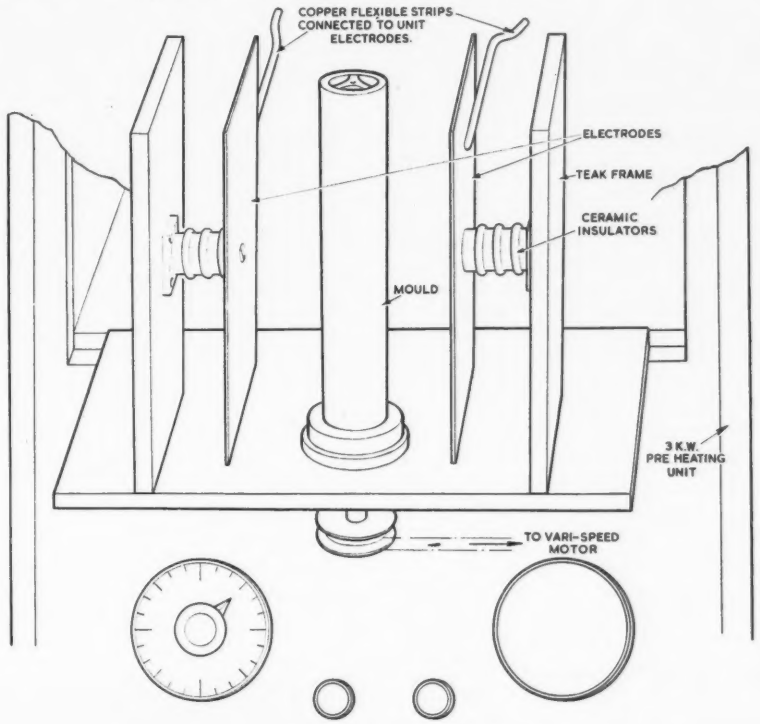

Fig. 1. Heating unit adapted to take cylindrical moulds.

In conventional methods of heating, metal moulds are used and can be made to very fine degrees of accuracy. As it was desired to produce a dimensionally accurate roller, it was necessary to choose a material which could be manufactured accurately or, alternatively, lend itself to easy machining. It had to be remembered, too, that to be of practical use the mould must be both robust and airtight, and of a material which is an insulator with a low loss factor.

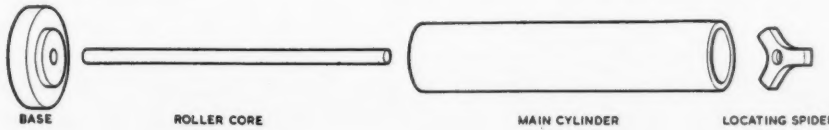

Fig. 2. Exploded view of cylindrical mould, connected to the electrodes by flexible copper strips.

* Gestetner Research Laboratories.

Glass, ceramic and resin-bonded paper laminates were all tried, as there was no obvious material to choose which had all the required qualities. Accurate glass tubing can be obtained easily and, indeed, gives the final roller a mirror-like surface. It is, however, difficult and expensive to mould bases and spiders in glass. It is necessary to have all parts of the mould of the same material, as uneven expansion of different materials during gelling will cause the mould to crack. A complete glass mould was made and used successfully, but rejected because it would be too brittle to use in general production and, as mentioned above, too expensive. Moulds of paper and asbestos laminates were both reasonably successful, but were not accurate enough. They also suffer from the disadvantage of peeling from the inside and have a comparatively low dielectric strength.

The most successful mould was one made from a ceramic material. This reasonably fulfilled all the requirements, and it was surprising to find that all the parts of the mould could be made and machined to size at a price slightly cheaper than a mould made of metal. Ceramic cannot be machined to the accuracy possible in metal work but, nevertheless, the tolerances lie well within those allowed in the moulding of rollers. The ceramic type of mould was chosen for the further experiments.

Roller Composition

The roller core consisted of a mild-steel spindle covered with a rigid polyvinyl chloride tube. This was placed in the base and centred in the mould by the spider. The plasticized p.v.c. used in the experiments was formulated as follows:—

60 parts by weight tri-tolyl phosphate
40 parts by weight Geon 121 or Corvic PM
2 parts by weight white lead.

Various other plasticizers were used, such as di-butyl phthalate and di-octyl phthalate, and also "Reoplex 200," a non-migrating type of plasticizer. The pastes were made up by orthodox methods and care was taken to ensure complete de-aeration.

The paste was then poured round the core in the mould, which was set rotating to ensure even heating. A set of gelation times (tabulated below) were obtained by varying the distance between the electrodes.

Electrode distance in.	2½	3	3½	4	4½	5
Time, min.	3	3½	5	7	9	12

Generally, it was found that when the outside of the roller was satisfactorily gelled, the centre was slightly decomposed. This slight decomposition was apparent by the yellowing of the roller centre, but was not regarded as serious because the mechanical properties were unchanged. When the electrodes were less than 3½ in. apart, flash-overs occurred, and these were more frequent when the outside of the mould was not perfectly clean. At 5 in., 120 flash-overs were experienced, and this was chosen as the reasonable working distance. Gelling times varied slightly when using tri-tolyl phosphate, di-butyl phthalate and di-octyl phthalate, and were almost doubled when using Reoplex 200. This is what we would expect as the latter is one of a class of polyester plasticizers which have threadlike-shaped molecules much larger than those of the ordinary type. Fully gelled rollers were obtained from pastes containing each type of plasticizer mentioned, and it was noticed that the polyester-type plasticizer seemed to have a heat-stabilizing effect on the composition. It was found possible to gel rollers based on Reoplex 200 without a stabilizer, but in order to be quite certain of their stability 5% white lead was added as for the other compositions.

The rollers moulded by the dielectric heating method not only possessed the desirable properties of those moulded in the conventional way, but had a much better bond between the rigid p.v.c. core and the gelled paste. In fact, the core appeared to be completely fused to the outer covering.

Unfortunately, in proceeding with the experiments it was found that a breakdown of the p.v.c. was taking place. At first this was thought to be caused by the metal spindle becoming overheated and decomposing the rigid p.v.c. in contact with it. Rollers without spindles were moulded and similar results were obtained. Large, clean holes some ¼ in. diameter would appear inside the gelled p.v.c. Their position in various rollers was not consistent and many experiments and adjustment of gelling conditions did not lead to the cause of the breakdown.

Conclusions

It is felt that a thorough investigation into all the components of the composition is necessary. Certain thermoplastic materials tend to develop a runaway condition when heated to temperatures above their decomposition points. Traces of impurities in either polymer, plasticizer or stabilizer might lead to this undesirable effect. Insufficient knowledge of the basic materials has made the pursuance of this idea to any conclusion impossible at the moment.

The author wishes to thank the directors of Gestetner, Ltd., for permission to publish this article, and for facilities afforded in its preparation.

EPOXY RESIN EXHIBITION

THE increasing range of applications to which epoxy resins are suited has created a market which will expand as their particular qualities and properties are recognized. To further this recognition and to show what the properties of this resin are, Shell Chemicals, Ltd., staged an exhibition to demonstrate the variety of industries which would benefit from the use of Epikote resins.

The properties of these resins, their toughness and flexibility, good adhesion, and resistance to chemicals and water have given them a ready market in the surface coating industry where, in conjunction with other resins, amines and fatty acids, they produce a range of stoving finishes. Products where such finishes had been employed range from washing machines to bicycle frames and included a metal tape measure, where full advantage had been taken of the flexibility of the resin, and the lining of a caustic soda tank where its chemical resistance has been exploited.

Nearer at home to the plastics industry was the use of Epikote resin as the basis of certain p.v.c. stabilizers. The recently introduced technique of "potting" miniature assemblies and other equipment used in electrical systems and radar, is one to which the properties of epoxy resins have lent themselves. Good resistance to thermal and mechanical shock, outstanding adhesion to metal inserts and low water absorption being the outstanding qualities which make them suitable.

Glass cloth laminates and glass fibre impregnated materials have received considerable publicity in recent weeks and it would appear that they are firmly established. So far the choice of resin used has been predominently of the polyester type, but the epoxy resins, because of their excellent adhesion to glass fibre, are now being used on an ever increasing scale. Example of their use in this field included a compressed air bottle manufactured by The Walter Kidd Co., Ltd., which has a capacity of 900 cu. in., and will withstand a working pressure of 3,000 p.s.i., and whose total weight (unfilled) is only 16 lb. Other examples included rods and tubes of glass fabric laminate for sporting equipment and chemical piping.

A section of the Epikote exhibition.
(*A Shell photograph*)

Epikote resin adhesives can be used as hot or cold setting compositions and have been developed for applications where high strength metal-to-metal bonds are required. Such conditions being found in the aircraft industry.

Considerable work is going on in various industries in the development of press tools, manufactured from filled casting resins and this has proved one of the major outlets for Epikote resins which, in combination with suitable fillers, have excellent toughness and compressive strength.

One interesting application was the use of an Epikote resin before and after metallization of an acrylic photographic flash holder. Not only is the reflecting surface protected from abrasion and oxidation, but also the actual metallic layer is keyed more firmly to the acrylic.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2s. 8d. each (including postage).

B.P. 718,349. Moisture-proof coatings for electrical components. To: Erie Resistor Corp. (U.S.A.).

A coating protecting the component at normal temperatures and not breaking down at elevated temperatures consists of a base coat of monochlorotrifluoroethylene and an exterior cover of a silicone varnish.

B.P. 718,359. Process for the modification of metal-containing synthetic resins. To: Chemische Werke Albert (Germany). Add to B.P. 718,283.

B.P. 718,390. Microporous material. To: Electric Storage Battery Co. (U.S.A.).

Increased porosity results in a greatly reduced resistance, e.g., of battery separators. The expanded thermoplastic resin is made from a mixture of starch and polyvinyl chloride (or copolymer) and a solvent. The material is shaped, the shaped article hot treated to swell the starch particles, the solvent then removed.

B.P. 718,403. Flexible tubes. To: Kopex-Maschinen A.G. (Switzerland).

The tube produced by coiling strip material has ribs projecting from the inner side of the tube wall. These ribs are of special advantage for tubes with insulating or sealing coating of polyvinyl chloride or other synthetic resin.

B.P. 718,422. Preparation of molecularly orientated coated films. To: E. I. Du Pont Nemours and Co. (U.S.A.)

The film base for a photographic film is a polymeric ester cast into a form, coated with a hydrophobic copolymer (35% vinylidene chloride) and then stretched at elevated temperature laterally and longitudinally.

B.P. 718,443. Machine for dispensing predetermined quantities of powder or granular material in loose or compressed form. W. R. Groves. To: British Industrial Plastics Ltd.

The die-holder which carries the supply container is horizontally reciprocated between a fixed and a movable punch. In the starting position, the fixed punch closes an aperture in the supply container and the movable punch closes the die opening. The die-holder moves towards the fixed punch and the material flows through the die opening while the movable punch (still stationary) appears to recede. The movable punch then starts to compress the material in the floating die against the fixed punch. On further movement of the die-holder and the return of the movable punch, the compressed article is ejected. All movements are hydraulically operated under automatic (electric) control.

B.P. 718,493. Method for preparing condensation products containing a phenol-formaldehyde resin and a polyamide or the like fibre-forming substance. To: Povazske Chemicke Zavody n.p., Kablo n.p. (Czechoslovakia.)

They adhere extremely well to metals (as insulating material), are useful as admixtures (varnishes, enamels, paints) and for spraying, moulding and other similar applications.

B.P. 718,497. Label tabs for file folders and similar articles. J. E. Addison. To: Shannon Ltd.

Bars and tabs may be made from plastic material, e.g. by extrusion or injection moulding. The tabs grip the bar and can only be removed by sliding off the end.

B.P. 718,515. Process for the production of thin layers of polyethylene on a support. W. Schermesser, W. Spindler. (Germany.)

The polyethylene is dissolved at above 65° C., cooled to form a solid gel, mechanically comminuted and applied in a thin layer to the support. When softened by heat then flattened, very thin layers on paper or textiles can be produced.

B.P. 718,517. Electrical condensers. H. D. Hemmer. To: Johnson, Matthey and Co., Ltd.

By providing a loop in each lead wire, the wire length within the plastic casing moulded in situ around the condenser is greatly increased.

B.P. 718,526. Methanol modified urea-formaldehyde resins. J. H. W. Turner. To: British Resin Products, Ltd.

B.P. 718,540. Scholastic device for teaching geography and like subjects. D. F. Braun.

A sheet of plastic cut to shape (country, continent) and having slots or holes defining boundaries or frontiers to serve as template for tracing outlines.

B.P. 718,610. Anti-dazzle screens for headlamps and other light projectors. G. Faccioni. (Italy.)

The screen is formed by a thin flexible sheet of transparent material with parallel corrugations stretched in a rigid frame.

B.P. 718,641. Tobacco smoke filtering bodies for use in or with tobacco products and methods of manufacturing such bodies. P. A. Mueller. (Switzerland.)

At least part of the fibres in the filter are plastic (nylon) fibres.

B.P. 718,650. Light diffusers for tubular lamps. J. Seidenberg. To: Seidenberg Frères.

Of moulded trough shaped elements of translucent plastic material (e.g. coloured, with numbers, signs, letters). It may be quickly fitted on tubes of any length.

B.P. 718,666. Fishing device. G. D. V. Wright.

B.P. 718,678. Nitrocellulose coating compositions. J. D. Brandner, R. H. Hunter. To: Atlas Powder Co.

B.P. 718,684. Method and apparatus for forming hollow cores for casting metals. A. J. Anderson. To: General Motors Corp.

A mixture of sand and synthetic resin is blown into a core defining cavity. This cavity is formed between a heated core pattern and an unheated member inside the pattern with perforated plugs as air escapes.

B.P. 718,685. Artificial tooth. W. Rauscher.

The synthetic tooth is provided on its surface with a layer of ivory powder, e.g. pressed into the neck of the root, acting as bone-nutrient so as to secure the tooth more quickly in the jaw. (Add. to B.P. 713,021.)

B.P. 718,825. Model railway tracks. E. Katryniak. To: Rovex Plastics, Ltd.

Each plastic base has on both ends tongues and sockets so that either end of any section can resiliently engage the next base. The inner wall of each socket and the inner side of each tongue are a continuation of one another along the centre line. (Add to B.P. 701,259.)

B.P. 718,897. Device for simultaneously withdrawing a liquid from and passing air to a container. B. Duval, R. S. Waddington.

A tube with an air reservoir enclosed within. The device may be made, e.g. from synthetic resin (polystyrene, polyethylene, polymethyl methacrylate).

B.P. 718,915. Paint containing polyvinyl acetate and chlorinated rubber components and process of making same. C. A. Pierard. To: Wright Stephenson and Co., Ltd.

B.P. 718,964. Book binder construction of plastic material. F. S. Schade. To: National Blank Book Co.

The binder case of plastic material is particularly useful in ring binders. Two flexible sheets with a stiffener strip inside are laminated together as the back, then welded to two cover sheets of stiff plastic material.

B.P. 719,024. Electrical plug connectors and contacts therefor. W. C. Fairweather. Comm. from: Singer Manufacturing Co.

A casing of moulded insulation material is preferably made of "Bakelite."

B.P. 719,029. Nozzles for vacuum cleaners. To: Electrolux, Ltd. (Sweden.)

A special arrangement of teeth and partition wall in the bounding rim to facilitate removal of particles adhering to the carpet.

B.P. 719,094. Containers for light-sensitive material. M. P. W. Blaber. To: Kodak, Ltd.

A container for a dose-meter (indicating X-rays, gamma rays, etc.), to be carried by personnel subjected to risk of exposure. The piece of sensitive photographic material is enclosed in a watertight, light-transparent sheath of plastic material.

B.P. 719,102. Foamed materials. To: Wingfoot Corp. (U.S.A.)

Organic carbonyl azides are admirably adapted as blowing agents not only for rubbery materials but also for polyethylene, polystyrene, etc.

B.P. 719,198. Galleries or holders for lamp shades. Volex Electrical Products, Ltd., A. O. Couyoumdjian.

A single (thermo-setting) moulding of a bridge member with two sets of curving legs, one set for supporting a shade, the other set for locking the shade.

B.P. 719,208. Handle for electro-medical treatment. E. W. Kjaer. (Denmark.)

The handle includes an electric resistance in a thermoplastic jacket with part of it projecting through the surface of the handle to be touched by the finger of the operator.

B.P. 719,291. Indicator plates such as name or number plates, panels and the like. H. Barker, L. N. Reeves. To: H.M. Postmaster-General.

A telephone dial is composed of a transparent front plate ("Perspex" or "Diakon") and a light-coloured backing plate with cavities containing luminous material arranged as background for the characters printed either on the rear of the front plate

or on the top face of the backing plates after application of the luminous material. The plates are then sealed together by welding or cementing.

B.P. 719,290. Cloches for blanching salads. R. Barbier. To: Ets. Barbier Frères.

A dome with a central extension moulded in a single piece from a cellulose paste impregnated with plastic material. The extension is provided with ventilation holes.

B.P. 719,302. Reservoir writing instruments. H. R. Fehling. To: Biro Swan, Ltd.

Formed by extrusion or moulding from cellulose acetate or polyethylene with interior longitudinal flutes (star-shaped cross-section). When formed by moulding the internal size must taper to extract the core.

B.P. 719,308. Prosthetic heads for arthroplasty operations. L. Balog.

The domed head may be cast, together with the skirt inlay, from plastic materials such as acrylic resins, polyethylene, nylon.

B.P. 719,311. Centrifugal pump. To: Farbwerke Hoechst A.G. (Germany.)

To obtain the required rigidity and resistance to corrosion when using plastic (polyvinyl chloride) parts, rotor and shaft consist wholly or partly of metal, which may be plastic coated, while the casing is of thermoplastic material. Eccentric construction is obtained by firmly fixing a wedge-shaped strip on the inside of an outer part of circular cross-section.

B.P. 719,317. Sausage and means and methods of producing it. J. J. Frank. (U.S.A.)

A flexible metal clip forming a sealing collar around a (polyethylene) bag.

B.P. 719,332. Coated films. To: Celanese Corp. of America. (U.S.A.)

Preparation of wrapping materials with a moisture-proof and heat-sealable coating. A film of cellulose acetate is covered on both sides with a composition containing a cellulose nitrate, a plasticizer and a certain polyamide.

B.P. 719,344. Floral displays. C. E. Bussert.

Flowers are coated with a suitable wax, which may be coloured, then enclosed in an inverted transparent sphere on a block of expanded polystyrene. The sphere is filled with pure water.

B.P. 719,351. Method and apparatus for producing wrapped articles. J. E. Brandenberger. To: Soc. La Cellophane.

B.P. 719,366/367. (Div. out of 719,351.)

B.P. 719,391. Injection moulding press. L. E. Soderquist. To: McNeil Machine and Eng. Co. (U.S.A.)

For moulding small articles of rubber, thermosetting plastics, and the like, in large quantities in multiple cavity moulds grouped around a central area where the articles are connected by a sprue. The plunger transfers the plastic material from the chamber into the cavities while the mould is closed. When the mould is opened the plunger is projected beyond the upper end of the chamber, lifts the core from its seat and ejects the articles.

B.P. 719,398/399. Measuring or indicating instruments. General Electric Co., Ltd., J. N. Bowtell, A. H. McKeag.

The pointer moves against a background provided by a glass plate as part of an electroluminescent device. The background becomes luminous on energization of the device. As transparent insulating resin, "Paralac 10" is suggested.

B.P. 719,429. Collapsible containers. W. E. Burman, A. J. Gudge. To: Flexipac, Ltd.

A thermoplastic (polyvinyl chloride, polyethylene) head portion is moulded around the end of a thermoplastic tubular body portion (formed by extrusion) and welded to it immediately upon formation. The heat for moulding and welding is supplied by high frequency dielectric heating.

B.P. 719,539. Polyurethane synthetic resinous products. L. N. Phillips. To: National Research Development Corp.

The foamed product may be used as the core layer of a sandwich structure (aircraft) and may be produced in situ; as adhesive, e.g., for metal-honeycomb cores for metal sandwich structures; as varnishes which are weather resistant and electrically insulating.

B.P. 719,564. Tobacco pipe. G. Defries.

A hole of small (3/64 in.) diameter is provided in the stem behind the bowl leading from the bore to atmosphere.

B.P. 719,572. Manicure device. S. T. Schuster. Reservoir with stopper and nib.

B.P. 719,580. Shaving brush. R. W. R. Butcher (New Zealand). A reservoir brush.

B.P. 719,598. Electric storage battery plates. R. M. Robson. To: D. P. Battery Co., Ltd.

Framework of synthetic plastic material with horizontal and vertical ribs defining compartments with conductors fitting into recesses in the same side of each of the horizontal ribs. Active material is pasted over the framework and surrounds the conductors.

B.P. 719,600. Fluorescent screen. To: E. I. Du Pont de Nemours and Co. (U.S.A.).

B.P. 719,604. Production of thermo-plastic tubing. Lacrinoid Products, Ltd., R. Hagen.

A polyvinyl chloride tube heated to become plastic and then expanded and allowed to cool retains the expanded form until again heated. Then it returns to its previous dimensions. A long length of tubing is intermittently passed axially through guides of progressively increasing diameter to a size slightly greater than the diameter of the contractile tubing to be produced. The expanded tubing may be used for covering handles, etc., by being slipped on, then heated to contract.

B.P. 719,608. Packages and a process for making same. To: Unilever, Ltd. (Netherlands).

B.P. 719,614. Fused fabric assemblies. L. Bihaly. To: Industrial Accountancy Partnership, Ltd.

As a stiffener for a temporary adhesive interlining to be fused with layers of ordinary textile fabric, an aqueous dispersion of a thermoplastic resin having a softening point between 40 and 130° C. is applied to the interlining resulting in a deposition of 2 to 5% thermoplastic of the weight of the interlining. This does not affect the adhesive properties of the material.

B.P. 719,664. Cheese package. F. H. Cherepow, G. W. Forcey. To: Marathon Corp.

An inner continuous film contains up to 40% polyethylene.

B.P. 719,688. Shoulder-rest for violin. E. M. Goldberger (Switzerland).

An elastic plastic (or metal) baseplate with a pad and resilient clamps.

B.P. 719,701. Nylon-reinforced copolymer resins. To: United Aircraft Corp. (U.S.A.).

Nylon fibres embedded in a thermosetting composition containing 100 parts butadiene acrylonitrile rubber and up to 500 parts phenolic resin.

B.P. 719,717. Method of producing novolaks. To: N. V. Philip's Gloeilampenfabrieken, Ltd. (Netherlands).

B.P. 719,729. Production of porous, shaped articles true to shape and size from synthetic thermoplastic materials. To: Badische Anilin und Soda-Fabrik (Germany).

Comminuted gas-containing polystyrene is heated to temperatures above softening point in moulds which are not gas-tight.

THE USE OF ETHOXYLINE RESINS IN MODERN TOOL MANUFACTURE

(*Continued from page* 30)

liquid cement or binder can run into these interstices when pouring.

After preparation, all the tools are carefully degreased. The punches at their cutting edges are covered with a thin layer of varnish, easily removed later, to a depth corresponding to the depth penetrated in the die. Its thickness equals that of the cutting gap between punch and die. When this varnish layer is dry, the punch is inserted in the die. The side of the punch-holding plate which is later screwed to the upper plate is lubricated thinly with a separating layer, e.g., on a silicone resin basis, and placed on a plate-supporting sheet covered with a double layer of paraffin-coated paper. The punch already in the die is completely inserted in the recesses of the punch-holding plate. The ethoxyline resin mixed with the hardener is then poured on the punch-holding plate, spread over it and left to set.

After setting is completed, the punch is withdrawn from the die and the varnish layer adhering to it removed with a solvent.

In the same way today, punches hitherto screwed in the baseplate are cast with ethoxyline resins and thus the set resin replaces the punch-holding plate.

In the foregoing description an attempt has been made to sketch a picture of the possibilities of using ethoxyline or epoxy-resins in all types of tool manufacture. The resins, on the basis of their advantages, have already made their mark as bonding agents, for the manufacture of blanking and piercing tools (up to 3 million operations) and as laminating resins for the manufacture of patterns and fixtures. Their use as casting resins for the manufacture of drawing tools is in the early stages of development. Experiments already made with deep-drawing sheet of 0.8 mm. to 1.5 mm. thickness, with chromium steel sheet, etc., raise hopes that thus a basis is created which will enable the toolmaker in the aircraft and motor-vehicle industry to obtain durable tools in a simple and cheap manner. It will be his problem to decide, as each case arises, which quality and type of resin is most suitable, and to reveal any defects encountered in use. It will be the problem of the chemical industry to remedy the disadvantages thus disclosed.

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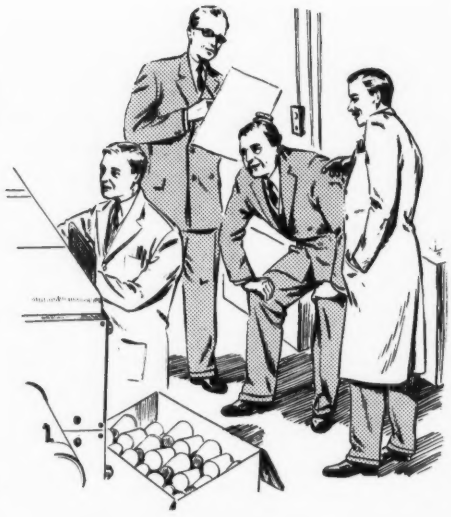

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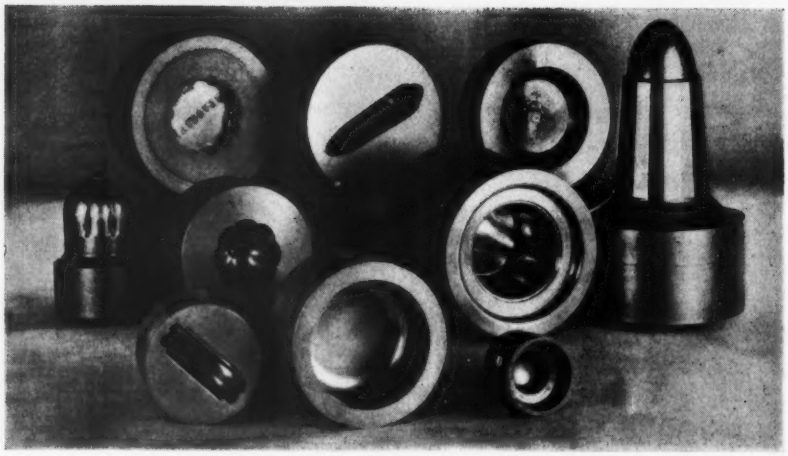

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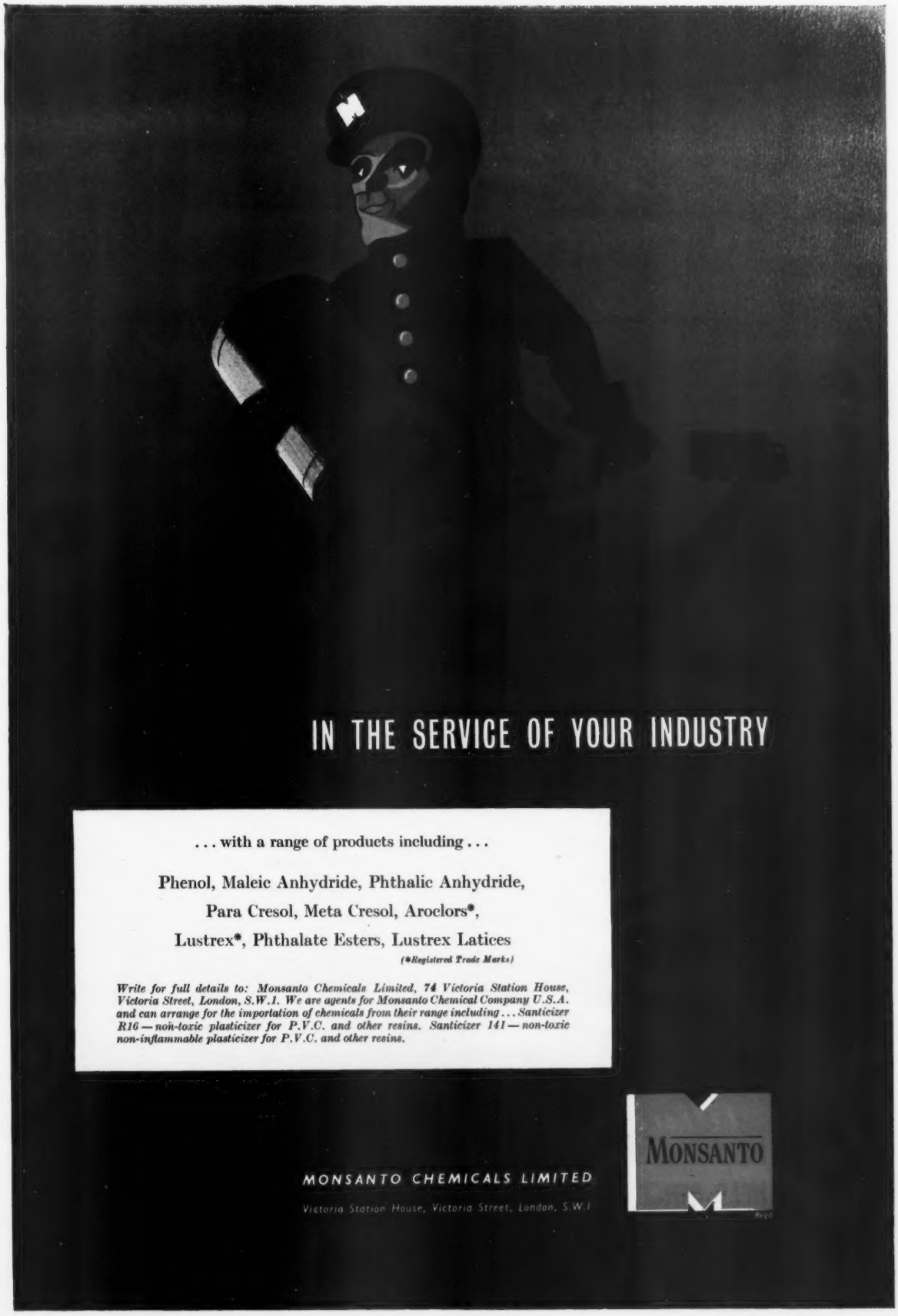
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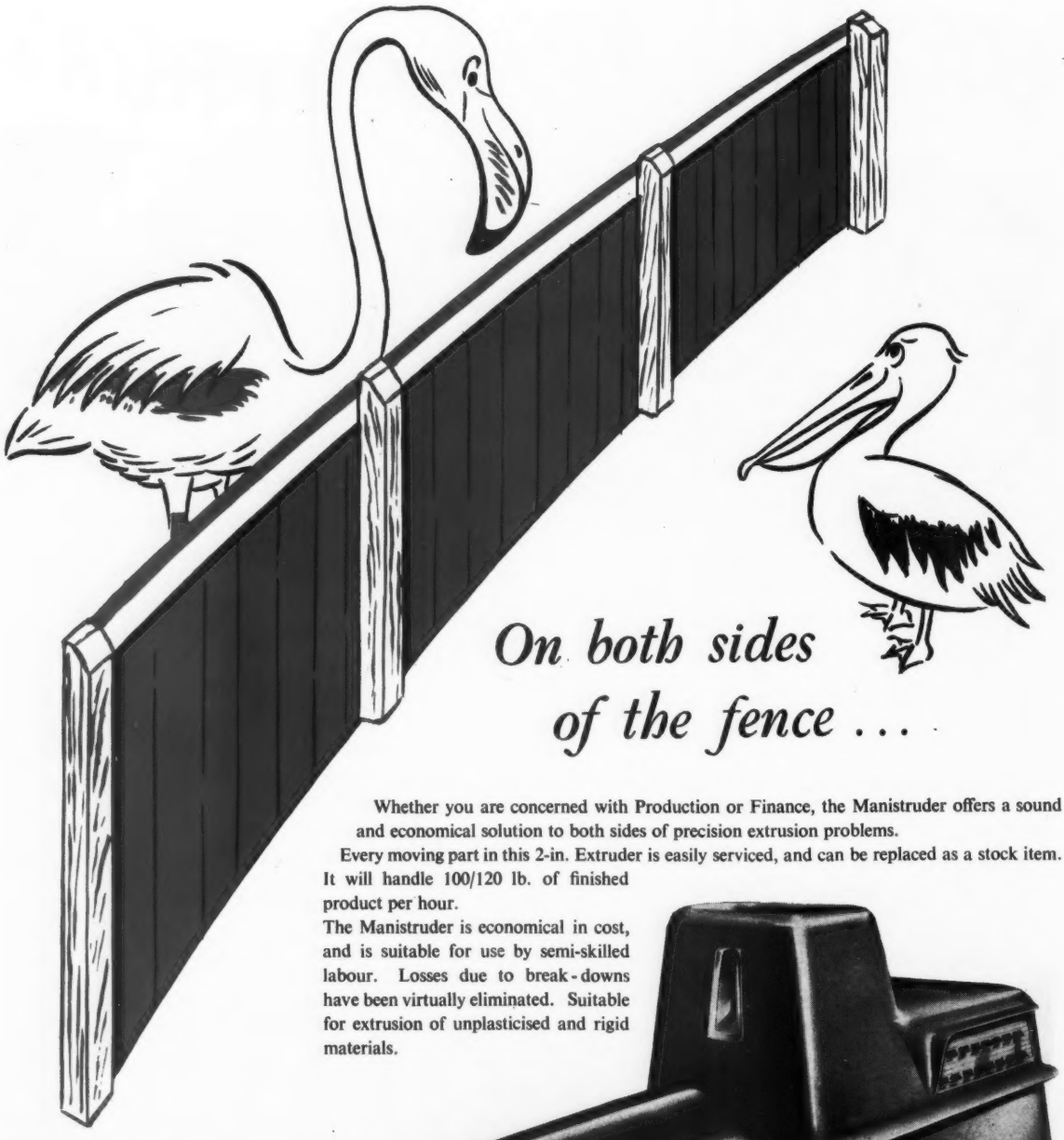

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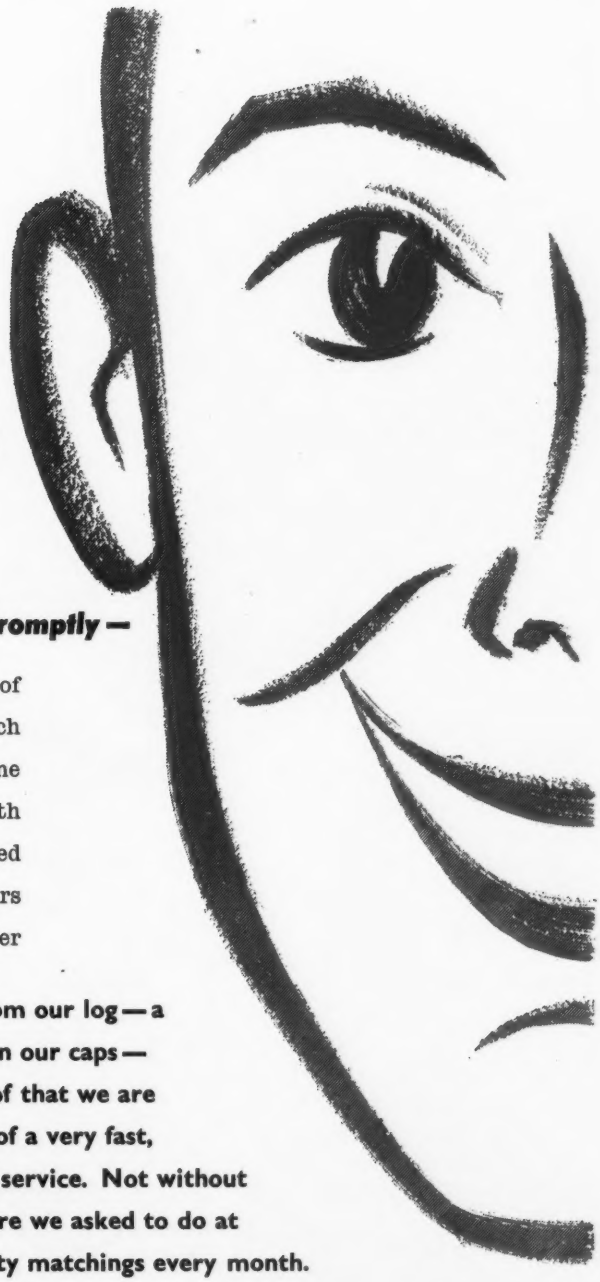

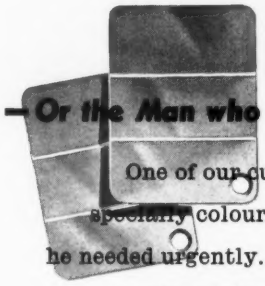

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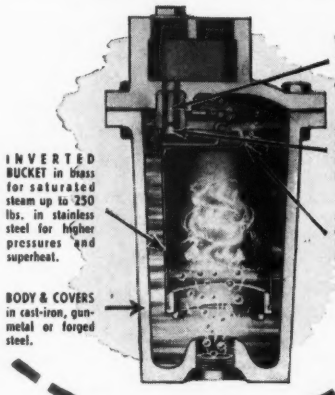
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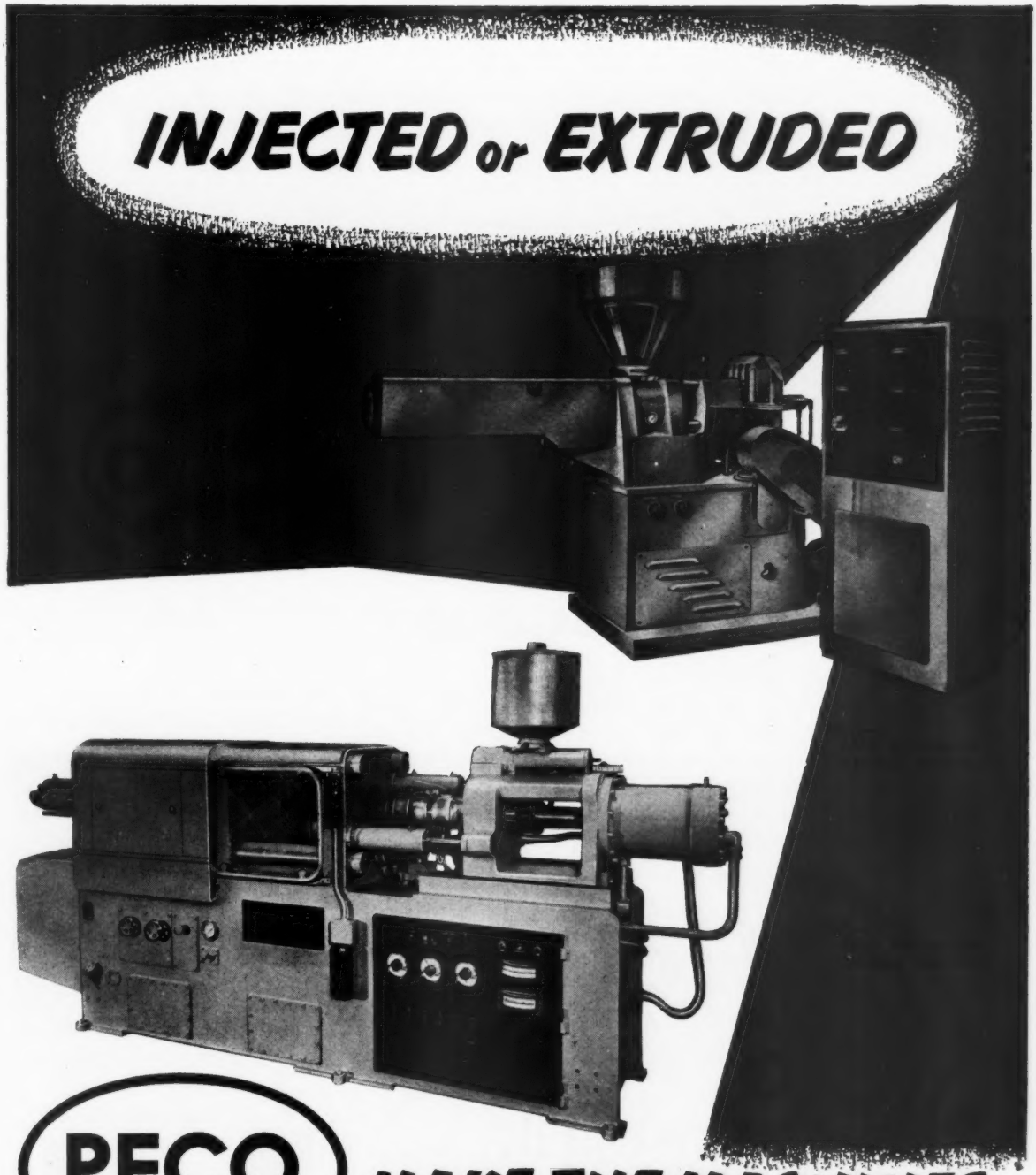

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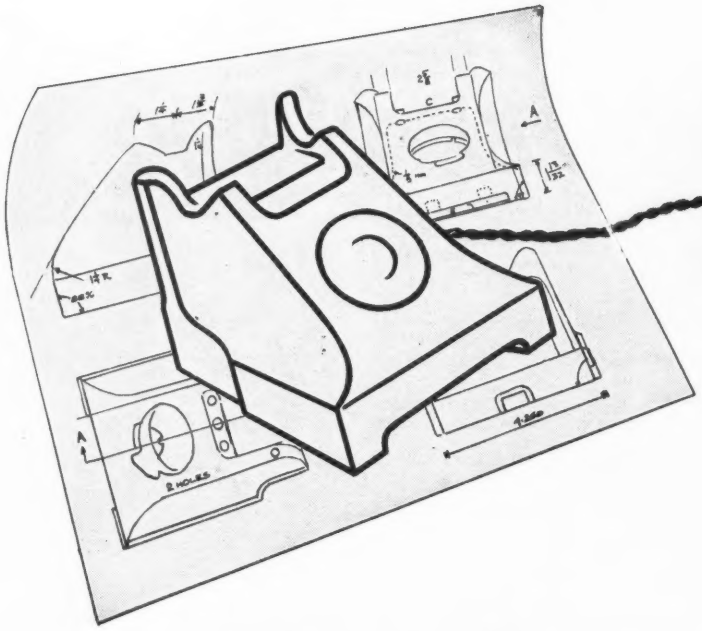

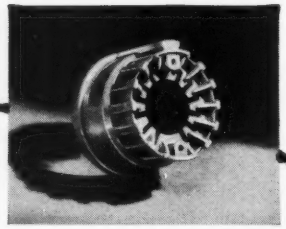

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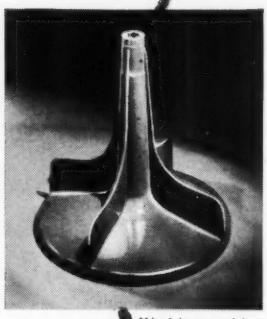
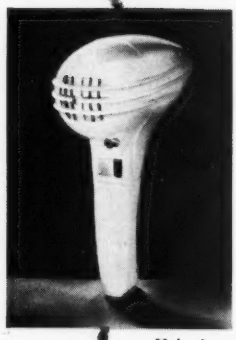
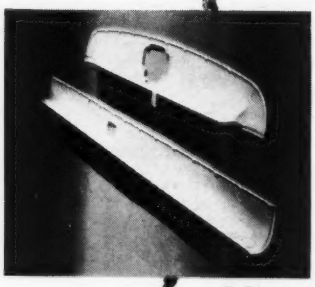


Washing machine agitator in **PHENOLIC**



Hair dryer casing in **UREA**



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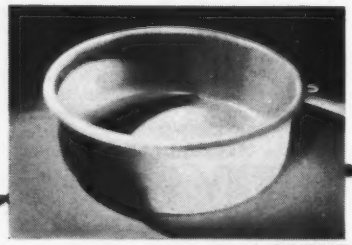

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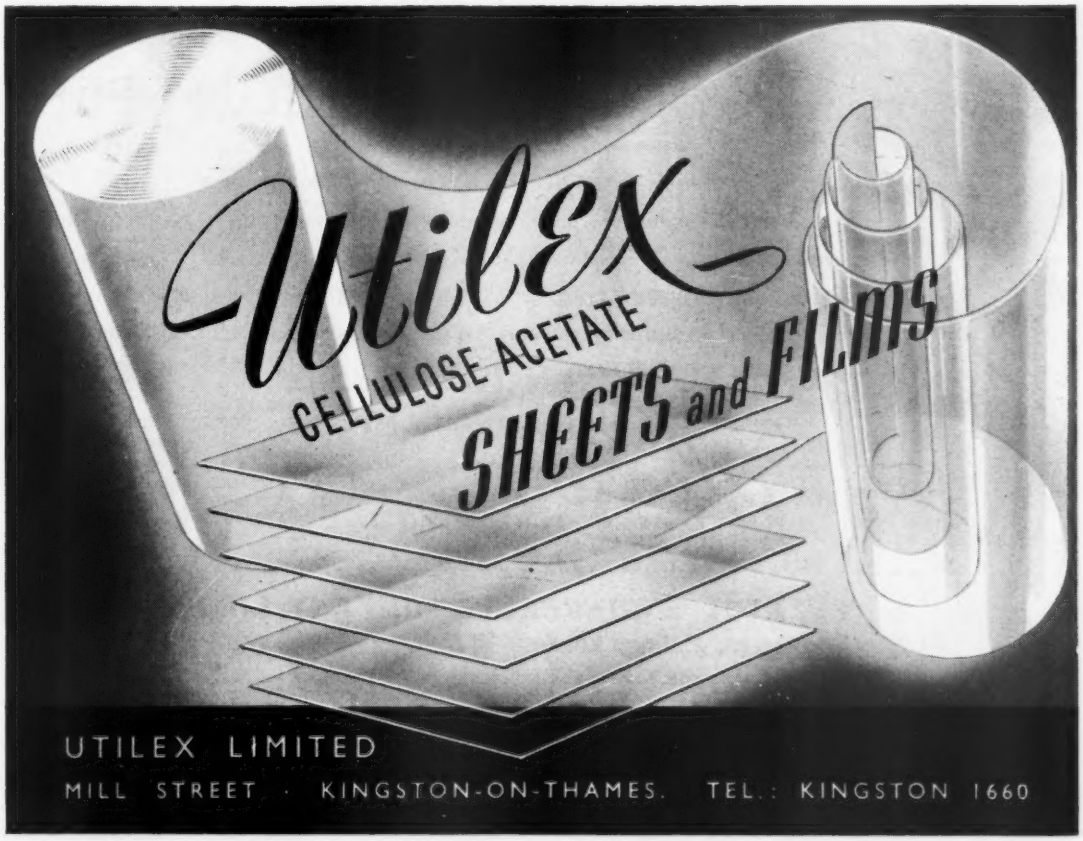

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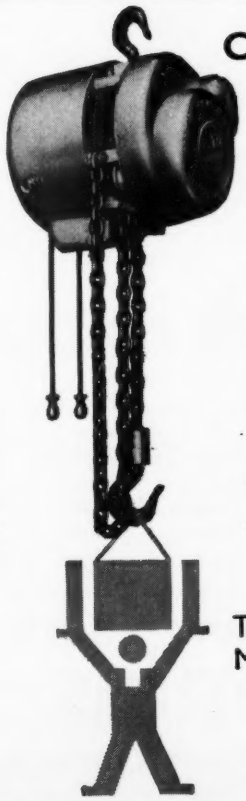

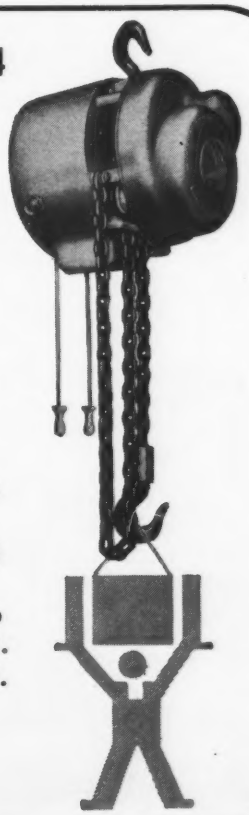

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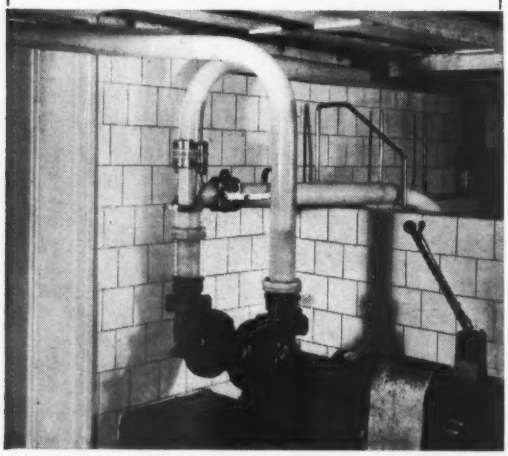

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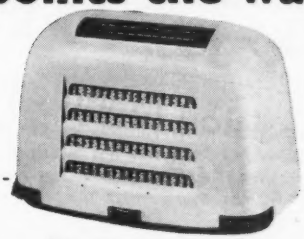

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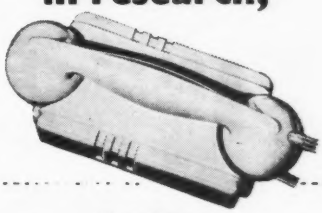

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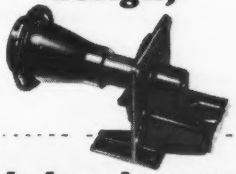

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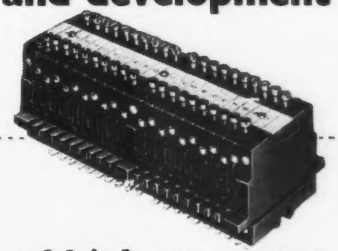

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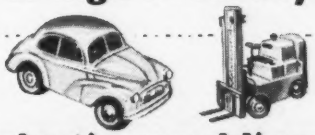

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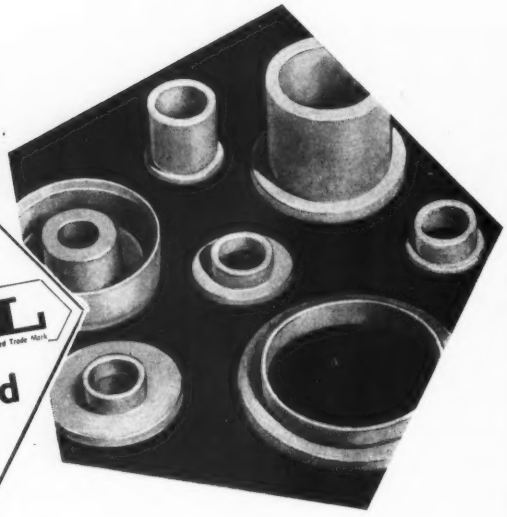

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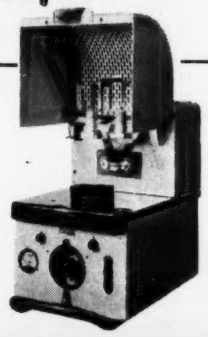

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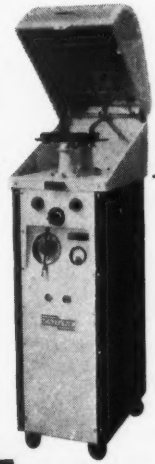

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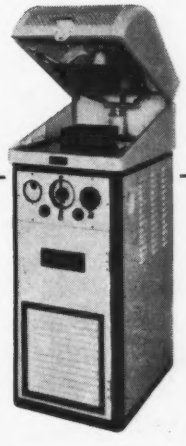

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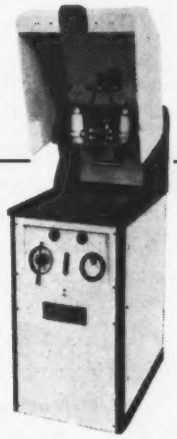

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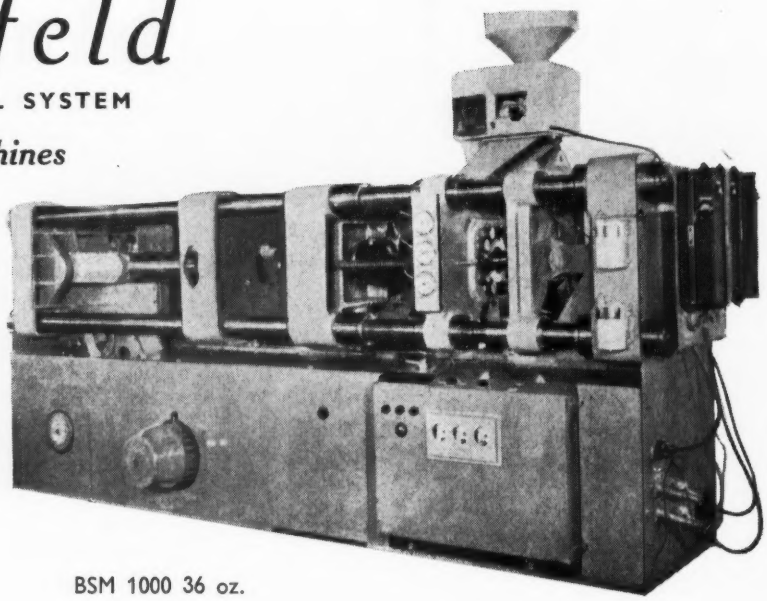

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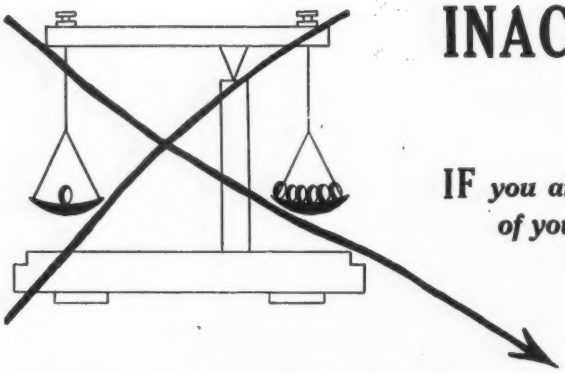

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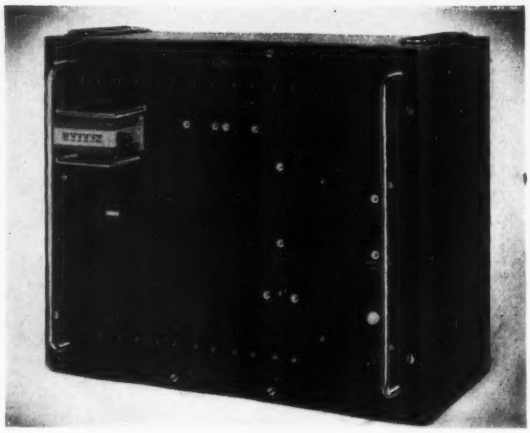

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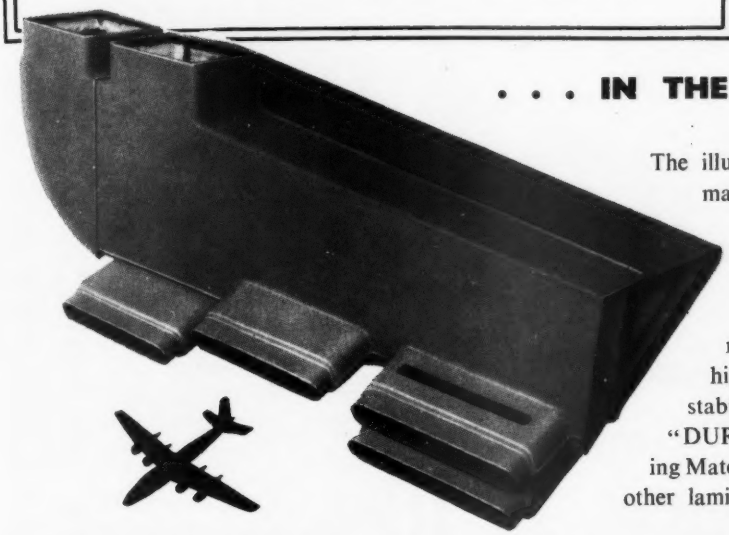

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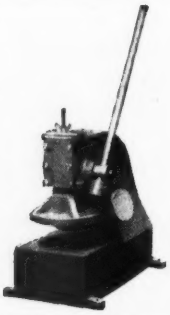

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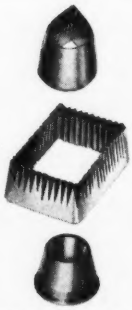

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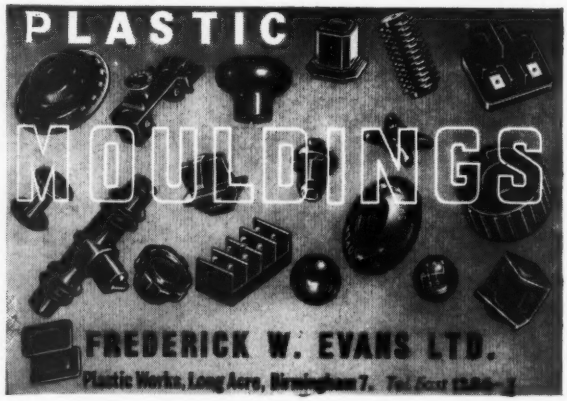

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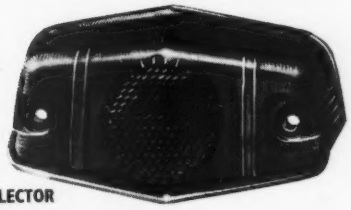

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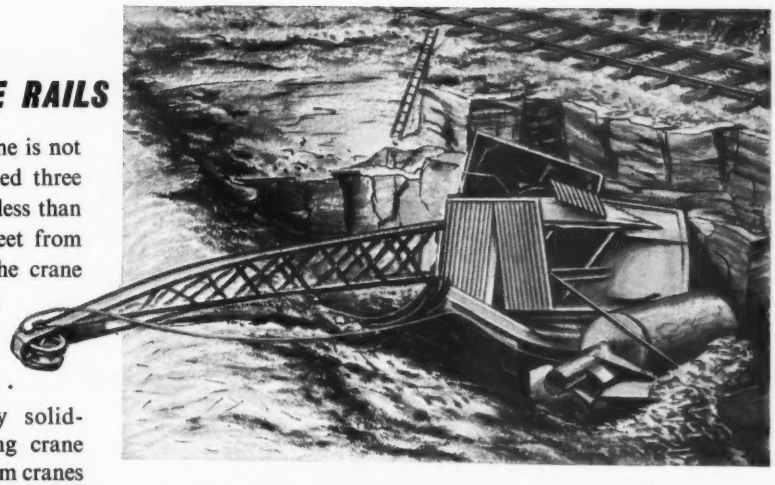

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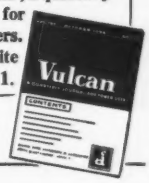

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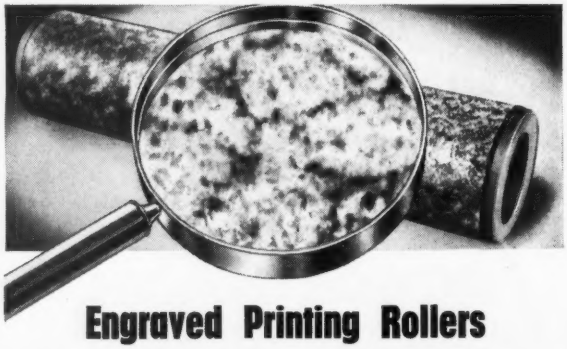
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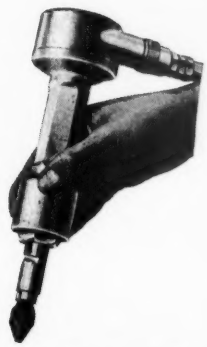

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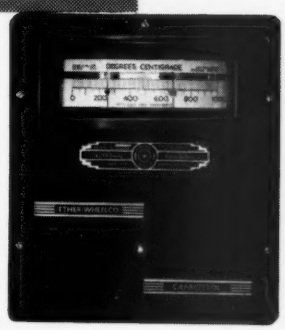

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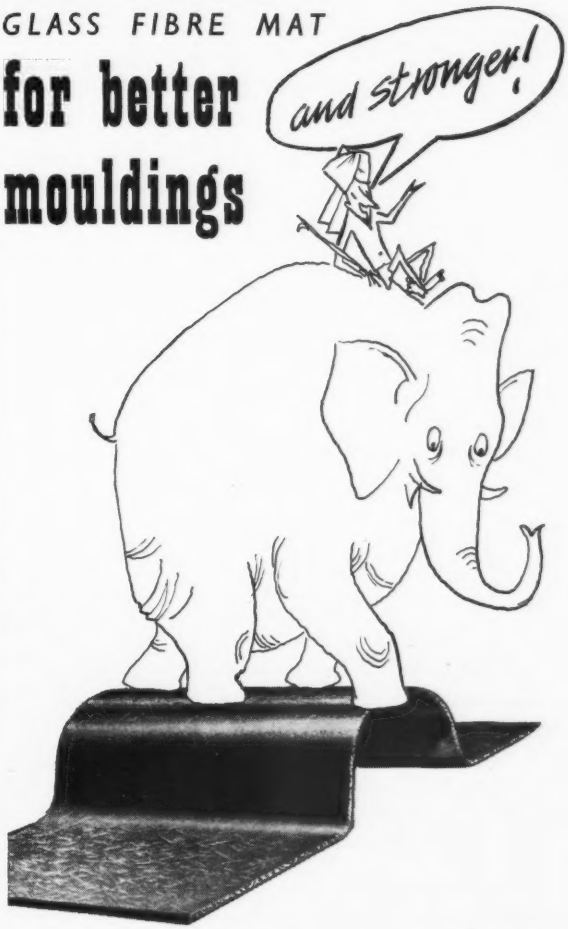

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SIX EDWIN MILLS 4-COLUMN HYDRAULIC PRESSES for sale. Pressure 2-11 tons; 1-20 tons; 3-15 tons. Platens 15 in. by 15 in.; average size, sold separately. Photo and full details from F. J. Edwards, Ltd., 359 Euston Rd., London. Euston 4681. 210-2

Machinery, Tools and Plant (contd.)

ALTERATIONS. Diesel sets, electric motors, switch gear, transmission equipment, fluorescent lighting and industrial fittings ex stock, keen prices. Contact G. L. Murphy, Ltd., Manston, near Leeds. zzz-489

NEW HIGH-SPEED ELECTRIC BANDSAWS for sale, for cutting polythene, p.v.c., rubber, Perspex, cork, leather, cloth, etc., stainless steel or wood table; three sizes, 24 in., 30 in., 36 in., max. height of cut on 36 in. machines 19 in., 400/440/3 phase supply. Illustration and prices from makers, F. J. Edwards, Ltd., 359 Euston Rd., London, N.W.1. Eus 4681. 210-11

TWO VACUUM COATING UNITS Type 3102, fitted with electrically heated oil cleaners. Machines very little used and in perform condition. Can be seen at London Works, by appointment. Reasonable price. Write Box P1025, care of "Plastics." 211-52

FOR DISPOSAL, patent and all tools covering a unique plastic electrical product. In hand orders, home and export, £1,200; average yearly sales £7,000. Price £1,350. Box P1037, care of "Plastics." 210-41

MACHINERY, TOOLS AND PLANT WANTED

COMPRESSION AND INJECTION MOULDING TOOLS WANTED. Send details of your surplus, obsolete and redundant moulding tools. Box P0720, care of "Plastics." 212-1082

INJECTION-MOULDING MACHINES required. Condition or size not important. Send details. Box P0814, care of "Plastics." 213-1090

TENSILE TESTER. Advertiser urgently requires Avery Goodbrand or Denison tensile tester for P.V.C., in good condition. Offers to Box P094, care of "Plastics." 210-1100

SECOND-HAND PLASTIC OR RUBBER MILL, in good condition, complete with drive bowl size 60 in. by 20 in. or 42 in. by 16 in. Box P1031, care of "Plastics." 210-46

WANTED, Manesty No. 3 tabletting machine. Box P1028, care of "Plastics." 210-48

WANTED, eight Upstroke Hydraulic Presses, 6-in. min. dia. ram, W.P. ½ ton min., 30 in. between columns one way, 12 in. min. daylight. Box P1029, care of "Plastics." 210-49

WANTED, Francis Shaw hand injection moulding machine. Box P1038, care of "Plastics." 210-x6938

WANTED: 1-2-oz. self-contained electric injection moulding machine, must be in good working order. J. and E. Brown, Nowell St., Wednesbury. Phone, Darlaston 212. 210-x7070

SECOND-HAND 1-in. to 2½-in. EXTRUDING MACHINE. Roll feed and water cooling, heating not required, collect in London area.
Details to H. D. Symons and Co., Ltd., Park Rd., Kingston Hill, Surrey. 210-10

MISCELLANEOUS

EXTEND YOUR TRADE.
Use a trade mark. Consult
Trade Mark Protection Society,
12 Church St., Liverpool. zzz-478

MOULDS

IF YOU NEED
IMMEDIATE AND INEXPENSIVE
INJECTION MOULDING CAPACITY
FROM 2 TO 32 OZS.
(BUT ESPECIALLY 8 OZ.)
CONTACT US WITHOUT DELAY.
AT BOX P0513,
CARE OF "PLASTICS" 210-1076

MOULDS WANTED

WE ARE INTERESTED in buying second-hand moulds for 3-oz./8-oz. injection moulding machines. Box P1040, care of Plastics." 210-x6958

PATENTS

PATENT NO. 676602 MOULDING MACHINE for sale or licence. Apply: Chatwin and Co., Patent Agents, 253 Gray's Inn Rd., W.C.1. 210-x7029

PRODUCTION CAPACITY

INJECTION MOULDINGS AND PLASTIC COVERINGS in acetate alkathene, p.v.c. machine parts in brass, steel and plastics.
We now have extra capacity and can offer quick delivery at our new factory. We solicit your inquiries.
F. A. Ketch and Son, Ltd., Trent Valley Works, Lichfield, Staffs. Litchfield 3052. zzz-476

KINGSTON PLASTICS, LTD., Unity Works, Union St., Kingston-on-Thames. Manufacturers of virgin and second-grade cellulose acetate moulding powders, matched to customer's own requirements for colour and flow. Customer's own waste also reprocessed to specified requirements. Sorting and grinding incorporating magnetic separation of metallic particles of all thermoplastics undertaken. Phone, Kingston 8405. 213-1084

DINES PRODUCTS, Whitehall Lane, Grays, Essex, for injection mouldings. 211-1050

REPETITION in Ebonite, Erinoid, etc. Capstan lathe work. Temple St., Rugby. 210-1043

CHIPPING OF PLASTICS AND GRINDING, screening, mixing and drying of all raw materials undertaken for the trade. Crack Pulverizing Mills, Ltd., Plantation House, London, E.C.3. Man 4405. zzz-487

INJECTION MOULDINGS IN THERMOPLASTICS. Moulding in styrene, acrylics and acetate. Design and toolroom facilities available for mould construction. Inquiries invited, J. and E. Courtenay, Ltd., 138 Stratford Rd., Birmingham, 11. 214-1093

Production Capacity (contd.)

PLASTICS (MANCHESTER), LTD.,
BRITAIN'S LEADING STOCKISTS AND DISTRIBUTORS.
SPECIALISTS IN
FABRICATION, INJECTION MOULDING AND ENGRAVING.
11 WHITWORTH STREET,
MANCHESTER, 1.
Central 7081-2 and Central 1000. zzz-468

SHORT RUNS A SPECIALITY: LONG RUNS A PLEASURE. Low mould cost and overheads. Injection capacity and technical knowledge at your service. Westminster Plastics, Temple Works, 41 Old Church Rd., Chingford, E.4. Silverthorne 7927. 212-01055

TUBE LAMINATION ENGINEERING, LTD.
High Wycombe, Bucks. Phone 1921-2.
Makers of synthetic resin-bonded tubes.
Round.
Square.
Rectangular.
Fabricators and assemblers in plastic and metals. Full supporting machine shop available. zzz-484

ELCO PLASTICS, LTD.
High Wycombe, Bucks. Phone 1921-2.
Over 50 presses.
Experienced compression, transfer and injection moulders.
Designers and makers of moulds on the premises.
Large assembly shops.
Capacity up to 500-ton compression and 10-oz. injection.
A.I.D. approved. zzz-485

VISIJAR LABORATORIES, LTD.,
THE LEADING CRAFTSMEN IN
"PERSPEX"
PROTOTYPE AND REPETITION.
OFFICIAL I.C.I. STOCKISTS "PERSPEX"
SHEET, TUBE, ROD.
STOCKISTS AND FABRICATORS OF "FORMICA."
149 LONDON ROAD, CROYDON, SURREY.
Phone, Croydon 8228 (2 lines). zzz-492

INJECTION MOULDINGS by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 220-1094

VACUUM MOULDERS invite trade inquiries for vacuum-formed articles, moulded in p.v.c. styrene, cellulose acetate, etc. Maximum mould size 36 in. by 36 in. Write Box P098, care of "Plastics." 210-39

COMPRESSION AND INJECTION MOULDING capacity immediately available in all thermosetting and thermoplastic materials. Customers' own moulds can be used or tools provided in our up-to-date toolroom. Box P996, care of "Plastics." 210-21

RAW MATERIAL

PERSPEX! PERSPEX!! PERSPEX!!! Official stockists for I.C.I. acrylic sheets. Sheets cut to your requirements. Fabrication and mounting specialists to the trade:—
S. C. Errington (Hanwell), Ltd., 132a Uxbridge Rd., Hanwell, London, W.7. Phone, Ealing 5288. zzz-40

SAVE TIME AND MONEY!
If you require a good service for turned parts in all plastics—or—
Supplies of casein, ebonite, fibre, laminated bakelite, in rods, sheets and tubes, or cellulose acetate and butyrate tubing, contact: A. E. Goodeve, Ltd., 188a Seven Sisters Rd., London, N.7. Archway 3654-6721. 211-1054

PLASTICS (MANCHESTER), LIMITED,
BRITAIN'S LEADING STOCKISTS
OF
PERSPEX SHEET, ROD, TUBE.
11 WHITWORTH STREET,
MANCHESTER, 1.
Central 7081-2 and 1000. zzz-488

PLASTICS, p.v.c., Perspex and scrap celluloid and sheet material. A. C. Rent and Co., Corsica St., Highbury, N.5. 210-1083

CELLULOSE ACETATE SHEET, several colours, bulk 60/1000-in., excess stock, price 6s. lb. Box P103, care of "Plastics." 210-29

ALWAYS LARGE STOCKS OF
CASEIN
RODS, TUBES AND SHEETS,
PERSPEX
SHEETS UP TO 1 IN. THICK.
CELLULOSE ACETATE
CATALIN RODS.
S.R. (PLASTICS), LTD.,
93 ALDERSGATE STREET, E.C.1
Phone, Monarch 4686. 221-1103

NYLON, coloured, reground injection scrap, small quantities regularly for sale. Offers invited. Box P1023, care of "Plastics 210-59

Raw Material (contd.)

POLYSTYRENE, reground, various colours and mottled, for disposal. Please inquire Box P1019, care of " Plastics. 210-56

POLYSTYRENE, PEARL, some light colours, new material, below cost price. Box P1021. 210-57

PHENOL FORMALDEHYDE, alkali resisting, some tons surplus to requirements for sale. Box P1015, care of " Plastics." 210-55

FOR HOME AND EXPORT MARKET. We sell at low prices, all plastic scraps, Acetate, Polystyrene, Alkathene, reground powders and reconditioned powders. Apply to Box P009, care of " Plastics." 210-37

BLACK CELLULOSE ACETATE MOULDING POWDER. We can always supply first grade at 2s. per lb., any quantity. Box P008, care of " Plastics." 210-36

CUEX, LTD., can offer all at prices well below current list:—
Polystyrene.
Cellulose acetate.
Polyethylene.
P.V.C.
Polyvinyl butyral.
Perspex and Diakon.
Send now for details.
Cuex, Ltd., 27 Corporation St., Birmingham. Central 5474. 210-65

RAW MATERIAL WANTED

WANTED, Polythene scrap. Write to Box P7416, care of " Plastics." zzz-0322

POLYSTYRENE, any colour. Full particulars to Box P033, care of " Plastics." zzz-479

SCRAP.
THE
LARGE BUYERS
ARE
MICHAEL S. STEVENS,
KESWICK ROAD WORKS, S.W.15.
Vandyke 3345-6. zzz-482

SURPLUS STOCKS of thermosetting and thermoplastic moulding powders wanted. Send details Box P056, care of " Plastics." zzz-481

ERLANOS, LTD., 93 Aldersgate St., E.C. (Monarch 4686), require Perspex and cellulose offcuts and scrap, clear and coloured, highest prices paid. 217-1079

PERSPEX. We buy scrap, offcuts, surplus and redundant stocks. L. Glazer and Son, Ltd., 275 Neasden Lane, N.W.10. Gladstone 7362. 211-1092

P.V.C. GARMENT AND HANDBAG OFFCUTS wanted. We collect and pay cash. Brockwell Plastics, Ltd., 50 Hollingbourne Rd., S.E.24. zzz-490

PROMPT CASH OFFERED for virgin and reprocessed cellulose acetate and polystyrene. Give manufacturer's name and packing. Box P873, care of " Plastics." zzz-491

ACETATE SCRAP, optical or sprues and runners and wasters in light colours without navy and red, 3 tons urgently wanted. Please quote. Box P1013, care of " Plastics." 210-54

POLYTHENE AND POLYSTYRENE, any quantities of virgin material, scrap, nozzle lumps, urgently wanted. Please offer with samples to Herbert Connor, Ltd., 120 Beaufort Park, Falloden Way, London, N.W.11. 210-58

CELLULOSE ACETATE SHEETING, clear 10 to 20 thou., any surplus lots required. Please offer with particulars to Box P1011, care of " Plastics." 210-53

WE ARE INTERESTED in buying polystyrene scrap and virgin materials in cash. Box P1039, care of " Plastics." 210-x6959

SCRAP.
WE BUY
ALL THERMO-PLASTICS. REJECTED MOULDED PIECES. OBSOLETE MOULDING POWDERS. LUMPS, SPRUES AND RUNNERS.
AND PAY HIGHEST PRICES.
J. W. NASH AND CO., LTD.,
27 BEETHOVEN STREET, W.10.
Ladbroke 4655. 210-38

RAW MATERIALS wanted. Polystyrene, polythene, C.A., P.V.C., Diakon, reject moulds, spews, runners, lumps, etc. Highest price paid. Prompt payment. Also spot lot origin. Box P1020, care of " Plastics." 215-1106

SITUATIONS VACANT

The engagement of persons answering advertisements in respect of vacant situations must be made through a local office of the Ministry of Labour, or a scheduled employment agency, if the applicant is a man between the ages of 18 and 64 inclusive or a woman between the ages of 18 and 59 inclusive, unless he or she, or the employment, is excepted from the provisions of Notification of Vacancies Order, 1952.

LABORATORY ASSISTANT required by company engaged in specialized plastic packaging field. Minimum standard, National Certificate with some analytical experience. Age limit 21 years. Salary dependent upon qualification and experience, but not less than £250 per annum. Box P091, care of " Plastics." 210-1098

INJECTION MOULDING ENGINEER required to demonstrate and service machines. Must have sound practical experience of moulding operation and moulding techniques. Mould design experience essential. The post will be permanent and offers scope for advancement for capable and energetic applicants. Please write to Box P095, care of " Plastics." 210-1101

Situations Vacant (contd.)

PRODUCTION CONTROL AND DEVELOPMENT. CHEMIST/TECHNOLOGIST required by company engaged in specialized plastic packaging field. Should have good knowledge of p.v.c. materials and preferably of soluable copolymers. Minimum qualification Inter B.Sc. or Higher National Certificate. Age not over 35 years. Salary according to age, qualifications and experience, but not less than £500 per annum. Box P092, care of " Plastics." 210-1099

DRAUGHTSMEN AND DESIGNERS.
E. K. COLE, LTD.,
EKCO WORKS, SOUTHEND-ON-SEA,
HAVE THE FOLLOWING VACANCIES:—
MOULD DESIGNERS AND JIG AND TOOL DRAUGHTSMEN
for the Plastics Division.
ELECTRONIC, RADIO AND TELEVISION DESIGNERS AND DRAUGHTSMEN
for Development and Engineering Departments.
MECHANICAL DRAUGHTSMEN
for Plant Layout in the Production Engineering Department.
APPLICATIONS TO
THE PERSONNEL MANAGER,
SOUTHEND-ON-SEA 49491. 210-17

SHEET FORMING SHOP. Foreman required, preferably experience vacuum and press-forming in Perspex and u.p.v.c. Factory in southern England. House available. Box P0916, care of " Plastics." 210-1095

REPRESENTATIVE required by leading manufacturers of p.v.c. plastic sheeting for outer London and Home Counties. Salary, commission, expenses. Write Box P0917, care of " Plastics." 210-1096

A SENIOR ESTIMATOR with engineering background required by Croydon firm specializing in injection moulding. Must be a practical man who has served apprenticeship and was in charge of toolroom or workshop. Drawing office experience on plastic moulds essential. Good salary with prospects of advancement. Apply by letter with full details of experience. Box P1024, care of " Plastics." 210-61

VACUUM FORMING TECHNIQUES.

Working technician capable of taking charge of design and development. Must have had extensive experience in working in foils for display and packaging. A man with keenness and initiative will have great scope in a small but rapidly developing company in the North West. Box P1041, care of " Plastics." 210-62

DRAUGHTSMEN. E. K. Cole, Ltd., Southend-on-Sea, require draughtsmen for their plastics division, experience of jig and tool or plastic mould design essential.

Write, stating age, qualifications and experience, to Personnel Manager. 210-12

ASSISTANT SALES MANAGER required by large and old-established plastic raw material manufacturers, salary dependent upon qualifications, must have experience in both sales office and outside representation, preferably connected with plastic sheet fabrication and a general knowledge of the plastic industry is desirable.

Applicants should be of good education standard and possess pleasing personality, age 30-40.

Write, giving full details, to Box T.4190/1, Foster Turner and Everetts, Ltd., 11 Old Jewry, London, E.C.2. 210-7

DRAUGHTSMAN, senior and junior, for plastic mould design. Write, stating age and experience, M.C.M. (Tools), Ltd., Denmark St., Aston, Birmingham, 19. 210-6

PLANNING ENGINEER. E. K. Cole, Ltd., Southend-on-Sea, have a vacancy in their plastics division for an assistant planning and methods engineer for large-scale plastic moulding production, workshop and drawing office experience in engineering or plastic industry essential.

Write, stating age, qualifications and experience, to the Personnel Manager. 210-5

SALES ENGINEER required by leading manufacturer of rubber and plastic machinery, must have sound engineering qualifications and practical experience in the rubber and/or plastics industries.

Age 25-35, good salary, firm's car.

Apply in writing to Sales Director, Francis Shaw and Co., Ltd., Corbett St., Manchester, 11. 210-19

FINNEY PRESSES, LTD., propose to appoint an experienced extrusion technician in connection with their manufacturing and marketing programme on Davis-Standard extruding machines.

The person appointed should have had experience in cable covering with plastics and rubber and in general extrusion techniques, also engineering qualifications with design and development experience in handling various materials.

He should be capable of advising customers on methods and procedures and of taking responsibility for the promotion of the programme outlined.

Apply, Finney Presses, Ltd., Berkley St., Birmingham, 1. 210-18

ESTABLISHED Plastic Material Merchants and Fabricators have vacancy for person to deal with sales inquiries. Experience an advantage, but young person would be trained. Permanent position with good prospects. Box P1032, care of " Plastics." 210-44

Situations Vacant (contd.)

CHIEF INSPECTOR to take charge compression and injection mouldings. Inspection experience essential. Old-established company in Slough. Permanent position, good wages and working conditions. Write details of past engagements, etc., Box P1017, care of " Plastics." 210-34

LEADING SYNTHETIC RESIN ADHESIVE MANUFACTURERS require a representative with technical qualifications and chemical background to direct and develop field technical service in existing and new outlets. The position is a senior one and affords an interesting career with good prospects.

Knowledge of industrial woodworking methods and high- and low-frequency heating an advantage but not essential.

Applicants must be prepared to travel mainly in the U.K. and preferably should be aged between 25 and 35. Salary according to qualifications.

Apply in writing to Box P1022, care of " Plastics." 210-60

DRAUGHTSMEN, intermediate, required for development work on plastic structures. Workshop and two to three years' drawing office experience with technical training to O.N.C. necessary. Intermediate or junior stressman to H.N.C. standard also required. Write full details to Box P1026, care of " Plastics." 210-51

EXTRUSION ENGINEER urgently required by small but rapidly expanding company, South-East London. Experience in extrusion all known materials essential, including handling of dies, heads, take-off equipment, etc. Good salary with excellent prospects. Write Box P1030, care of " Plastics." 210-47

A COMPANY IN AUSTRALIA installing a four-bowl American calender line for the production of p.v.c. film intend to recruit in the United Kingdom senior personnel for the operation of this plant in Australia, and the following vacancies will occur in or about May, 1955:—

Production Manager experienced in control and planning for the production of film, sheeting, etc., preferably with knowledge of Farrell Birmingham equipment. Salary according to qualification, probably £2,000 (Australian) p.a.

Chemist with practical experience in quality control of film and sheeting, etc., formulation of p.v.c. compounds and, if possible, colour experience. Salary according to qualifications but probably £1,500-£1,700 (Australian) p.a.

Three or four experienced Calender Operators would be required to train and use unskilled labour in operating the plant. Salaries £1,000-£1,500 (Australian) p.a.

Houses at a nominal rental are already in existence, and the employer would pay fares from United Kingdom to Australia.

Applications for the above posts, in confidence, to Box P1027, care of " Plastics." 210-50

P.V.C. CHEMIST/TECHNOLOGIST required for production control and development. Some experience of the coated fabrics industry would be an advantage but is not essential.

Applications stating qualifications and salary required will be treated in confidence and should be addressed to the Managing Director, Bernard Wardle (Everflex), Ltd., Peblig Mill, Caernarvon. 211-1104

SALESMAN required for progressive tool making concern specializing in injection compression and die casting tools. Technical knowledge essential. Good prospects for right applicant. Box P101, care of " Plastics." 210-31

A SENIOR EXECUTIVE is required for the new plastics department of a large engineering concern in the North of England. Applicants are required to have a practical knowledge of thermoplastics extrusion and moulding and to have had managerial and commercial experience in manufacturing industry.

The successful candidate will be required to take charge of production, for which he will be directly responsible to the Board, and to supervise the distribution of products to industrial consumers.

The position is permanent and pensionable; salary will be in accordance with qualifications and experience.

Applications with full details of experience and present salary to the Secretary, Box P102, care of " Plastics." 210-30

SALES REPRESENTATIVE well introduced amongst manufacturers of plastic fancy goods, rainwear, etc., in Midlands and Northern area, required on commission basis by firm specializing in patent plastic fasteners. Reply Box P104, care of " Plastics." 210-28

CHEMIST required aged 23 to 30 with knowledge of plastics, for metal and plastic spraying works in North West London. Good prospects. Superannuation. B.Sc. or similar degree necessary. Reply with full details of age, experience and salary required, to Box P105, care of " Plastics." 210-27

PLASTIC EXTRUDER OPERATORS wanted, new houses available, Bracknell, Berkshire. Excellent prospects. Box P109, care of " Plastics." 210-23

PRODUCTION MANAGER required S.W. London, age 28-35, experience in Injection Moulding, able to control male and female staff, good prospects and pension scheme.

Write in first instance giving details of past experience and salary required to Box P1012, care of " Plastics." 210-22

MOULD DESIGNER (free lance) for design of compression moulds for electrical accessories. Only fully experienced man having wide knowledge of design and moulding technique need apply. London area preferred but not essential. Generous fees. State details of experience in first instance which will be treated in strictest confidence. Staff have been advised of this advertisement. To Director, Box P107, care of " Plastics." 211-1105

FOREMAN required for injection moulding shop in Gloucestersire. Good opportunity for man with comprehensive experience, drive and ability to control labour, first-class salary awaits first-class man. Box P108, care of " Plastics." 210-25

Situations Vacant (contd.)

SALES REPRESENTATIVE required. New company specializing in manufacture of chemical plant and supply of tube, fittings, etc., to chemical plant manufacturers in p.v.c., polythene, etc. House available, excellent opportunity for man with chemical engineering background and knowledge of application of plastic materials. Box P1010, care of " Plastics." 210-24

ASSISTANT CHEMIST of Intermediate B.Sc. or equivalent standard required for control and development work on U.F. resins, moulding powders and P.V.C. extrusion materials.

Applicant should have completed military service. Salary range £450/500.

Apply in writing to Chief Chemist, Lacrinoid Products, Ltd., Gidea Park, Essex. 210-14

OPPORTUNITIES to join the Technical Department of a company operating a group of factories making chemicals and plastics on a large scale, are offered to chemists and chemical engineers; investigation of existing processes, development of new methods and layouts, are the main jobs of this department which calls for well-trained, qualified and imaginative people; new recruits are needed because of promotion of existing personnel to management positions and general expansion of the company.

There is also a vacancy for an analytical chemist to be assistant to the Chemist in charge of a Control Laboratory.

The plant is modern and sited in a pleasant non-industrial area. A non-contributory pension scheme is operated.

Please write in confidence, giving a concise account of experience and education to Box P106, quoting ref. R.47. 210-26

CHARGEHAND SETTER required for injection moulding department. Thoroughly experienced men only need apply. Works situated north-west coast area. Accommodation available (low rent) to suitable applicant.

Write fully stating details of previous employment, age, and rate required to Box P1035, care of " Plastics." 210-42

AN EXCEPTIONAL OPPORTUNITY OCCURS for keen man with experience of prevision sawing, routing and spindling laminated plastics, to take charge of new cutting shop and train staff. Permanent position, good salary and bonus. Old established London company expanding. Box P1033, care of " Plastics." 210-45

A MECHANICAL ENGINEERING DESIGN DRAUGHTSMAN is required for plant layout, maintenance and process development work in Plastics Manufacture.

Applicants, who should preferably possess a Higher National Certificate, should apply to The Secretary, Ashdowns, Ltd., Eccleston, St. Helens, Lancashire, giving full details of their qualifications and experience and details of salary required. 210-8

Situations Vacant (contd.)

PLASTIC TECHNOLOGIST required, experienced in compounding, processing and development work, excellent opportunity for capable man, permanent position, house available if necessary.

Replies treated in confidence. Middlesex area. Box P1016, care of " Plastics." 210-32

DRAUGHTSMAN AND TOOL DESIGNER for compression and injection moulding. South-west London. Good wages and prospects. Pension scheme.

Write fully, stating age, experience and salary required. Box P1034, care of " Plastics." 210-43

COMPANY WITH INTEREST IN NEW PROJECTS AND MATERIALS requires a technical assistant to development engineer. Applicants should have received an adequate standard to fit them for further training and must be adaptable and able to act on own initiative. Commencing salary £450 per annum. Non-contributory pension scheme in force. First application by letter to Howard Clayton-Wright, Ltd., Wellesbourne, Warwick. 210-16

THE PLASTICS DIVISION OF UNIVERSAL METAL PRODUCTS, LTD., have a vacancy for a Senior Design Draughtsman, preferably with experience in the field of Plastic Moulding Tools.

The position is permanent and provides an excellent and remunerative opening, including Pension and Life Assurance facilities, for a man of initiative and imagination. Please address hand-written applications with full particulars to the Secretary, Universay Metal Products, Ltd., Langley Rd., Pendleton, Salford, 6, Lancs. 210-15

WORKS MANAGER—A rapidly expanding Company in the N.W. invite applications for the now vacant position of Works Manager to take control of process production and engineering matters.

Applicants should possess a good technical degree and be widely experienced in modern aspects of plant management but not necessarily in plastics. This appointment carries an attractive salary and the Company operates a generous non-contributory Staff Assurance Scheme. Existing staff have been informed of this advertisement.

Applications, which will be treated in strictest confidence, to the Managing Director, Styrene Products, Ltd., 96 Piccadilly, London, W.1. 210-13

A TECHNICAL SALES REPRESENTATIVE, aged between 28 and 40 years fo age, is required for a firm engaged in the manufacture of plastics. Applicants should have an engineering background and preferably some knowledge of the applications of plastics and experience in selling. The successful applicant will be required to work in the London Area and Home Counties, and will be engaged in making contact with potential and existing customers and following up inquiries.

Applicants should send full details of their qualifications, experience and salary required to The Secretary, Ashdowns, Ltd., Eccleston, St. Helens, Lancashire. 210-9

Situations Vacant (contd.)

MOULDING SHOP LEADING FOREMAN to take charge of compression moulding shop. Old-established company in Slough. Permanent position, good wages and working conditions. Write details of past engagements, etc. Box P1018, care of " Plastics." 210-35

JOHNSON, MATTHEY AND CO., LTD., require two graduate chemists, age 25-35, for the research laboratories of the Ceramic Division located in the N. Midlands.

One man is required for investigation into pigments and experience of the paints or plastics industries would be considered an advantage.

The second man is required for research in the field of ceramic colours for the glass and pottery industries.

The appointments will be made to the permanent staff and carry full superannuation. Salary according to qualifications and experience. Write, giving full particulars of age, education and experience, to The Secretary, Johnson, Matthey and Co., Ltd., 78 Hatton Garden, E.C.1. 210-33

SITUATIONS WANTED

EXPERT PLASTIC MAN with 10 years' experience (in Germany), tooling, metal welding, press, casting, seeks responsible position. Box P1042, care of " Plastics." 210-64

TIME RECORDERS

TIME RECORDERS. Several available, both manual and electric, at low prices. Blackfriars Precision, Ltd., 154-6 Blackfriars Rd., London, S.E.1. Waterloo 3131 (five lines). 210-4

FACTORY TIME RECORDERS. Service rental. Phone, Hop 2230. Time Recorder Supply and Maintenance Co., Ltd., 157-158 Borough High St., S.E.1. 221-1102

WANTED

WANTED, January and February copies, 1952, of " Plastics." Offers to Box P1014, care of " Plastics." 759-x7030

BOOKS AND PUBLICATIONS

COLOUR CARDS AND SAMPLE BOOKS are made by Alfred Thornton, Ltd., of Joseph St., Bradford, Yorks. Phone, Bradford 23308. zzz-471

THE THEORY OF POLYMERIZATION, by H. R. Fleck, M.Sc., F.R.I.C. Full examination in simple language with examples, calculations and exercises of this fundamental aspect of the chemistry of plastics. Illustrated, 144 pages, 10s. 6d. net from booksellers, or 11s. by post from the publishers, Temple Press Ltd., Bowling Green Lane, London, E.C.1. zzz

PLASTICS, SCIENTIFIC AND TECHNOLOGICAL (3rd edition), by H. R. Fleck, M.Sc., F.R.I.C. A completely revised edition of a recognized standard work on the chemistry and technology of plastics. " . . . should be in every technical library."—Times Review of Industry. Illustrated, 440 pages, 40s. net from booksellers, or 40s. 9d. by post from the publishers, Temple Press Ltd., Bowling Green Lane, London, E.C.1. zzz

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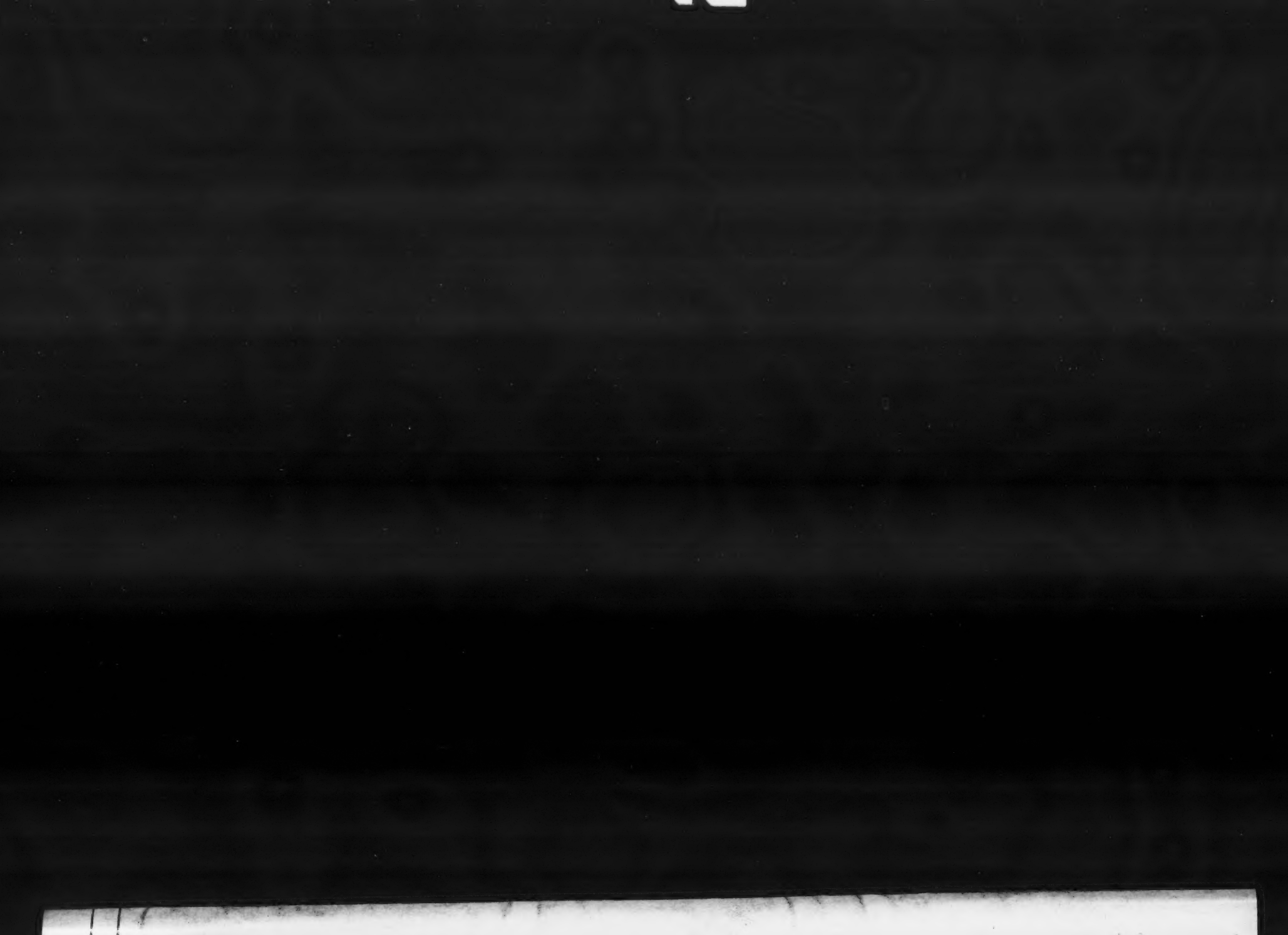
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